

SPOKANE RIVER BRIDGE
AT SPOKANE, WASHINGTON

BY
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ARMOUR INSTITUTE OF TECHNOLOGY

1911

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UNIVERSITY OF MICHIGAN
SERIALS ACQUISITION
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Construction of the Spokane River Bridge

of the

Idaho & Western Railway

at

Spokane Bridge, Wash.

A THESIS

presented by

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to the

President and Faculty

of

Armour Institute of Technology

for the degree of

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CONSTRUCTION OF THE SPOKANE RIVER BRIDGE,
IDAHO & WESTERN RY.

Object:- To describe the method of construction of the Spokane River Bridge at Spokane Bridge, Wash., on the Idaho & Western Ry.

General Description:- The Idaho & Western Railway Co. recently completed a line from Dishman, Wash. to Coeur d'Alene, Idaho, a distance of 25.3 miles. At Dishman a connection with the Oregon-Washington Railroad & Navigation Co. gives access to Spokane on the west, and to the main line of the Chicago, Milwaukee & Puget Sound Ry. on the south, via Plummer, Idaho.

The Idaho & Western Ry. is a subsidiary company of the Chicago, Milwaukee & Puget Sound Ry., being more familiarly known as the Coeur d'Alene Branch. To the north of the line is the Spokane Valley, well known as productive of fruits and garden truck. To the south are the foot hills of the Coeur d'Alene mountains, having a good growth of pine and fir.

The small scale map on page 5 shows the new line colored red, the main line of the Chicago, Milwaukee & Puget Sound Ry. being shown dotted.

Immediately after passing the Washington-Idaho

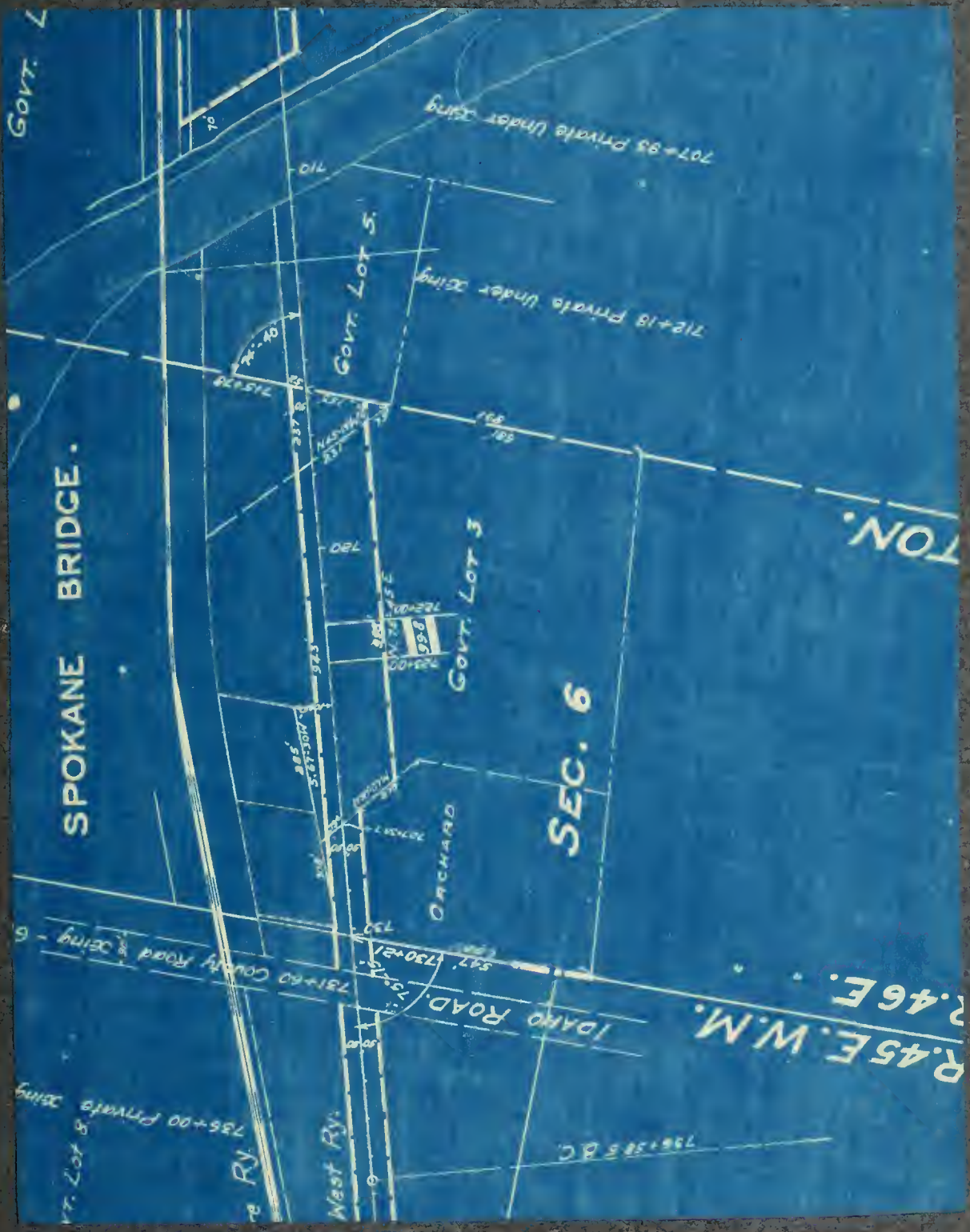
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to the main line of the Chicago, Milwaukee & Puget Sound
Ry. on the south, via Pinner, Idaho.

The Idaho & Western Ry. is a subsidiary company of the
Chicago, Milwaukee & Puget Sound Ry., being more facil-
ity known as the Coeur d'Alene branch. To the north
of the line is the Spokane Valley, well known as pro-
ductive of fruits and garden crops. To the south are
the foot hills of the Coeur d'Alene mountains, having
a good growth of pine and fir.

The small scale map on page 2 shows the new line
colored red, the main line of the Chicago, Milwaukee &
Puget Sound Ry. being shown dotted.
Immediately after passing the Washington-Idaho



SPOKANE BRIDGE.

SEC. 6

Govt. Lot 3

Govt. Lot 5

ORCHARD

IDaho ROAD

West Ry.

707+98 Private Under Leasing

712+18 Private Under Leasing

731+60 County Road & Leasing - 6

735+00 Private Leasing

Govt. L

TON.

R.45 E. W.M.

R.46 E.

736+58 S.D.C.

70

710

715.28

337.8

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State line the railway crosses the Spokane River, 18.5 miles from Spokane and 12.1 miles from Dishman. The entire structure, including the west approach, is in Idaho.

The Idaho & Western bridge crosses the river 400 feet up stream from the new crossing of the Inland Empire System. The old crossing of the Inland Empire System being about 300 feet down stream from the new, and is being considered as a crossing structure for the new state road. The town of Spokane Bridge, Wash. being within a quarter of a mile of all their structures is most appropriately named.

The Spokane River bridge consists of two reinforced concrete arch approaches and three concrete piers. Four 80 foot steel girders form the spans. The piers are constructed to accommodate a future second track to be constructed south of the present line. (See map on page 11) The approaches were constructed for single track, with the footings only for the future second track structure.

The concrete approaches are reinforced above the footings and are decked with reinforced concrete slabs, built on the ground and placed after setting.

state line the railway crosses the Spokane River, 12.5 miles from Spokane and 12.1 miles from Dickinson. The entire structure, including the west approach, is in Idaho.

The Idaho Western bridge crosses the river 400 feet up stream from the new crossing of the Inland Empire System. The old crossing of the Inland Empire System being about 500 feet down stream from the new and is being considered as a crossing structure for the new state road. The town of Spokane Bridge, Idaho, being within a quarter of a mile of all their structures is most appropriately named.

The Spokane River bridge consists of two approaches and concrete arch approaches and three concrete spans. The four 80 foot steel girders form the spans. The approaches are connected to accommodate a future second track to be constructed south of the present line. (See map on page 11) The approaches were constructed for single track, with the footings only for the future second track structure.

The concrete approaches are reinforced with the footings and are backed with reinforced concrete abutments built on the ground and placed over settling.

At present the deck on the steel girders is of timber, but this will be replaced by reinforced concrete slabs in the near future.

Under each of the approaches is a private roadway constructed by the railway company for adjacent property owners. These roads are gravel filled and have grades not exceeding 8 per cent.

The concrete construction and roadway work was done by the Bates & Rogers Construction Company of Chicago and Spokane. The following articles of the contract show its general nature:

(1) The contractors agree to furnish all the labor, superintendence, and to handle the work of construction, the employment of necessary labor and the purchase of material ordered by the engineer, is to be in accordance with the Chief Engineer's instructions or authority, which also covers the rates for labor and the terms and prices for purchases. The work is to be done in accordance with the plans, specifications, instructions and requirements of the Chief Engineer of the railway.

(2) Furnish all equipment, plant and tools required for the performance of the work.

(3) Provide and furnish the camp and to board the employes.

At present the track on the ... is of ...
but this will be replaced by reinforced concrete sleepers
in the near future.

Under each of the approaches is a private roadway
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prices for purchases. The work is to be done in accord-
ance with the plans, specifications, instructions and re-
quirements of the Chief Engineer of the railway.
- (2) Furnish all equipment, plant and tools requir-
ed for the performance of the work.
- (3) Provide and furnish the crew and to employ the
employees.

(4) Commence the work forthwith and to handle it at such a rate of progress as will secure completion prior to greater difficulty incident to the fall floods and unfavorable weather.

The Railway Company agrees to

(1) Pay the contractors their pay roll for labor and for supervision employed on the work in the actual performance of the same.

(2) Pay the purchase cost of all material entering into the construction of the work.

(3) Pay the contractors the agreed per cent on items (1) and (2) as compensation for their tools, equipment, their services and their profits. (Freight charges are not included in the amounts on which percentage is paid.)

The steel work was built by the railway company and erected by company forces.

Camp:- The camp site for this work was located on the west side of the Spokane river, being within a short distance of Spokane Bridge, a station on the Inland Empire System, where all supplies and materials were shipped to. The topography of the country is very flat and a gradual down grade from the town to the work, over a good gravel road, made easy teaming.

(1) Commence the work forthwith and to handle it as

such a rate of progress as will secure completion prior to greater difficulty incident to the fall floods and unfavorable weather.

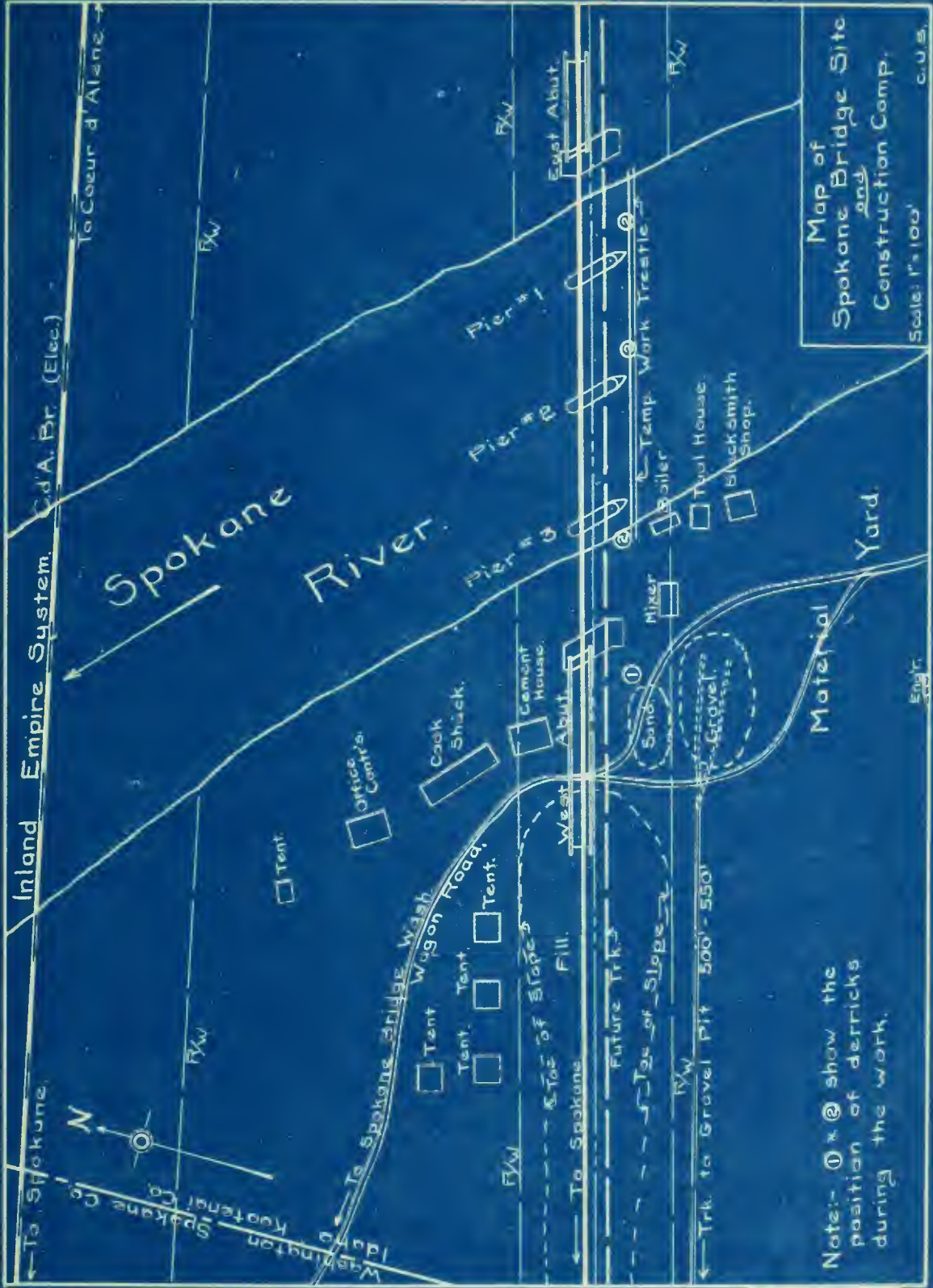
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Camp - The camp site for this work was located on the west side of the Spokane river, being within a short distance of Spokane bridge, a station on the Inland Empire State, where all supplies and materials were shipped. The topography of the country is very flat and a gravel town grade from the town to the work, over a good gravel road, made easy traveling.



Map of
Spokane Bridge Site
and
Construction Camp.
Scale: 1" = 100'.
C.U.S.

Note: ① * ② show the position of derricks during the work.

Reference to the map on page 11 shows the location of the camp to good advantage. All the work was done on the south, or up stream side of the line. On this side the blacksmith shop, tool house, boiler, mixer and material yards were located. To the north of the line were the cement storage house, contractors office and commissary, cook shack and sleeping tents.

The camp being almost entirely off of the railway company's right of way, a small rental was paid to the owner for the use of the site. Although the land could have been used free, the payment of a small sum released the occupants from any damage claims which might have arisen during the course of construction.

As the contract states, the camp was run entirely by the contractors and they made all the profit derived from it. A price of 25 cents per meal was charged and deducted from the men's time. A commissary furnished the men with tobacco, gloves, clothing, etc., credit being given against the time checks.

The buildings for the camp were put up at the expense of the contractors, excepting those actually used in the performance of the work. Upon the completion of the work all buildings were removed and the site left as it originally was. The contractors sold the material in their camp build-

Reference to the map or plan will show the location of
the camp to good advantage. All the work was done on the
right, or on upper side of the line. On this side the
ditch, boiler, boiler, boiler, boiler, boiler, boiler,
were located. To the north of the line were the
cabin store house, contractor's office and commissary,
and also the sleeping tents.

The camp was almost entirely off the railway
company's right of way, a small rental was paid to the owner
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contractor, and all the profit derived from it.
A price of 25 cents per meal was charged and deducted from
the contractor's time. A commissary furnished the necessary
supplies, and the contractor being given against the
camp.

The buildings for the camp were built at the expense
of the contractors, excepting those actually used in the
performance of the work. Upon the completion of the work
all buildings were removed and the site left as it originally
was. The contractors were the rate paid in their contract -

ings for a lump sum, while that for the railway company's buildings was returned to the second hand stock.

Plant & Equipment:- The contractors plant for this work had an estimated value of approximately \$15,000 and consisted of the following equipment:

One 1/2 yard Smith concrete mixer, boiler and engine attached.

Five bottom dump Stuebner cone buckets.

Two 6 1/4 x 10 American hoisting engines complete.

One 50 ft. mast guy derrick complete.

One 30 ft. mast stiff leg derrick complete.

One 40 H.P. Nagle portable boiler with fittings.

One 5" Emerson pump.

One Gould centrifugal pump with engine attached.

(Used engine only.)

One 6 x 4 x 6 Fairbanks Morse force pump.

One 6 x 4 x 6 Laidlow & Dunn force pump.

One 5 1/2 x 7 Comstock upright engine.

One skid pile driver complete, 30 ft. leads.

One 2800 lb. pile hammer.

One 800 lb. pile cap.

Three concrete cars (One lost in river) complete.

Two push cars, complete with trucks.

One gravel car, complete with trucks.

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Item 1 - Equipment

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One 40" circular saw.
One 36" circular saw.
One 2 1/2" shaft for saw.
Four #2 slip scrapers.
Sixteen steel tray wheel barrows, 2 ft. capacity.
Six cross cut saws.
Eighteen #2 shovels, D handle, round point.
Ten #2 shovels, D handle, square point.
Four long handle round point shovels.
Three spades.
700 ft. 1" dia. manilla rope.
600 ft. 1 1/4" dia. manilla rope.
300 ft. 5/8" dia. manilla rope.
4610 ft. 1/2" wire hoisting rope.
1840 ft. 5/8" wire guy rope.
60 picks with handles.
Six pike poles.
Three 8 lb. mauls.
Eight 10 lb. mauls.
One set blacksmith tools.
One forge complete with blower.
One grind stone, 2" face.
One Barren track jack.
One 150 lb. anvil.

One 10" circular saw.

One 28" circular saw.

One 2 1/2" shaft for saw.

Four 2 slip bearings.

Sixteen steel tire wheel barrows, 2 ft. diameter.

211 cross cut saws.

Eighteen 2 shovels, handles, round point.

Ten 2 shovels, handles, square point.

Four long handle round point shovels.

Three spades.

700 ft. 1" dia. manilla rope.

600 ft. 1 1/4" dia. manilla rope.

300 ft. 3/8" dia. manilla rope.

400 ft. 1/2" wire rotating rope.

1500 ft. 3/8" wire guy rope.

50 ft. with handles.

211 iron poles.

Three 8 lb. nails.

Eight 10 lb. nails.

One set blacksmith tools.

One forge complete with blower.

One grind stone, 24" face.

One barrier track jack.

One 100 lb. weight.

ARCADE
INSTITUTE OF TECHNOLOGY
LIBRARY
CHICAGO, ILL.

Five cant hooks.

Four carry hooks.

Seven axes.

Four pair of rubber boots, hip.

Five double blocks, wood.

Four double blocks, iron .

One snatch block, iron.

Six ship augers.

Three timber dollies.

Two Marshalltown trowels.

Two vises.

Five monkey wrenches.

Three pipe wrenches.

One pipe cutter.

One set Armstrong stock and dies.

One set Little Giant stock and dies.

One 10" x 12" split pulley.

One 2" and one 3" flue roller.

One small sand screen.

Six lanterns.

Crow bars, claw bars, pinch bars, chains, etc.

Other equipment on the work, but not actually used in construction consisted of:

One Clam shell bucket.

Five cant hooks.

Four carry hooks.

Seven axes.

Four pair of rubber boots, etc.

Five double blocks, wood.

Four double blocks, iron.

One snatch block, iron.

Six ship augers.

Three timber bolters.

Two Marshalltown trowels.

Two vises.

Five monkey wrenches.

Three pipe wrenches.

One pipe cutter.

One set Armstrong stock and dies.

One set little flat stock and dies.

One 10" x 12" split pulley.

One 2" and one 3" line roller.

One small sand screen.

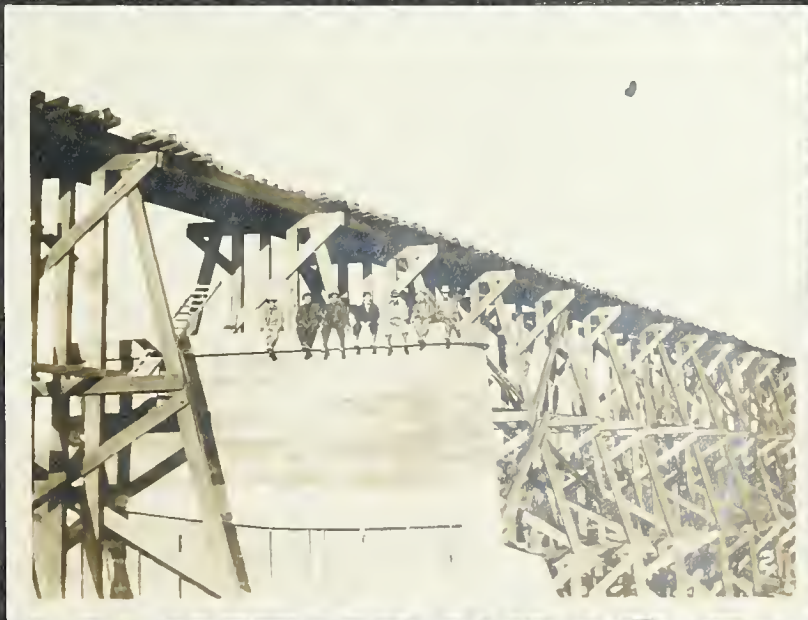
Six lanterns.

Crow bars, claw bars, pinch bars, chains, etc.

Other equipment on the work, but not actually used in

construction consisted of:

One 100 lb shell bucket.



One orange peel bucket.

One 50' mast guy derrick complete.

The camp equipment consisted of four 16 x 18 tents, 12 oz., stoves, etc. with a cooking outfit for 150 men.

The engineers outfit consisted of one 14 x 16 tent, one 7 x 7 tent, drafting table, chairs, desk and the customary engineering instruments. All the tents were framed, floored and half walled covered with tarred paper.

Material:- Gravel:- The gravel for this work was a good coarse grade, that would mesh 90% through a 3/4" sieve, lying under a lava strata, was taken out of a pit on the railway company's right of way and washed there, it was then dumped into a car and carried down to the work on a gravity track and unloaded at the storage pile as indicated on the map page

The gravel was picked up in the pit with slips. It was then dumped through a trap and washed with a hose, as it went down a 30 degree incline to the storage hopper. The car was run under this hopper and filled. The outlet of the hopper being arranged with a trap door operated by a lever.

When a car was filled it was started down grade to the storage pile, where it was dumped and returned to the loading hopper with a horse.

the orange peel bucket.

The 50' mast guy wires complete.

The camp equipment consisted of four 12' x 14' tents,

in one, stoves, etc. with a cooking outfit for 150 men.

The engineering outfit consisted of one 14' x 16' tent,

one 7' x 7' tent, dressing table, chairs, desk and the

customary engineering instruments. All the tents were

traced, flared and half walled covered with tarred paper.

Installation: - Gravel: - The gravel for this work was a

good coarse grade, that would mean 70% through a 3/4" sieve,

lying under a low strata, was taken out of a pit on the

railroad company's right of way and washed there. It was

then dumped into a car and carried down to the work on a

gravity track and unloaded at the storage pile as indicated

on the map page.

The gravel was picked up in the pit with a dipper. It

was then dumped through a trap and washed with a hose. As

it went down a 30 degree incline to the storage hopper.

The car was run under this hopper and filled. The outlet

of the hopper being arranged with a trap door operated by

a lever.

When a car was filled it was started down grade on

the storage pile, where it was dumped and returned to the

loading hopper with a horse.

The force on this work averaged two slip teams with drivers, one horse with driver to pull back empty car, two men on car, two men on slips, one washerman and three men on the dump. About 100 yards a day were handled with one car, 2700 yards were hauled, the average haul being 500 to 550 feet.

Sand:- The sand was obtained from a local pit about one mile south of the work. It was loaded at the pit in 1 1/2 yard wagons and dumped on the work at the storage pile.

The sand was bought at a unit price per yard, engineer's measurement, and hauled at a contract price per yard. The average delivery per day was nine yard per team, three teams working only when the roads were in good condition.

Nine hundred and fifty-five and one half yards of this sand, which was sharp and of a fine grade, were delivered.

Cement:- The cement used was the Santa Cruz blue cross brand. It was shipped from Seattle via Plummer, Idaho and Spokane over the Chicago, Milwaukee & Puget Sound RY., Oregon-Washington Railroad and Navigation Co. and Inland Empire System to Spokane Bridge, Wash. It was unloaded there by the contractors and hauled to the store house, a distance of about 350 yards.

The force on this was estimated to be about 100 tons. The driver, one horse with driver to pull back on it, and two men on it, one on right, one on left and three men on the dump. About 100 yards a day were handled with one car, 2000 yards were handled, the average haul being 300 to 500 feet.

Sand:- The sand was obtained from a local pit about one mile south of the work. It was loaded at the pit in 1 1/2 yard wagons and dumped on the work at the storage pit. The sand was bought at a unit price per yard, engineering measurement, and hauled at a contract price per yard. The average delivery per day was nine yard per test, three teams working only when the roads were in good condition. Five hundred and fifty-five and one half yards of this sand, which was sharp and of a fine grade, were delivered.

Cement:- The cement used was the Santa Clara brand. It was shipped from Seattle via Ilwaco, Idaho and Spokane over the Chicago, Milwaukee & St. Paul R.R. to Oregon-Washington Railroad and Navigation Co. and thence by the contractor and hauled to the store house, a distance of about 350 yards.

The average labor to unload and store was about four teams and two men with driver for each team. There were 30 sacks to a load and approximately 900 sacks in a car. 14 cars were received.

12067 sacks were delivered, 11902 sacks were used in the work, 157 sacks were sent away on rush work, 8 sacks remained to be returned to stock. The cement was shipped in sacks of four to a barrel.

The cement was sampled in the cars before shipment, only two cars being sampled at the work. The following are the figures of a test of one sample.

Tensile Strength

Lbs. per square inch

<u>1 day</u>	<u>7 days</u>	<u>28 days</u>
485	790	825

Time of Setting

<u>Initial Minutes</u>	<u>Final Hours</u>
110	4 1/2

Fineness

Per cent of residue on

#100 sieve #200 sieve

1.8

13.2

The average labor to unload and store was about four
 teams and two men with driver for each team. There were
 20 sacks to a load and approximately 900 sacks in a car.
 14 cars were received.
 12007 sacks were delivered, 11902 sacks were used in
 the work, 127 sacks were sent away on trash work, 8 sacks
 remained to be returned to stock. The cement was shipped
 in sacks of four to a barrel.
 The cement was sampled in the cars before shipment,
 only two cars being sampled at the work. The following
 are the figures of a test of one sample.

Tensile Strength

psi. per square inch

1 day	7 days	28 days
433	790	825

Time of Setting

Initial minutes	Final hours
110	4 1/2

Fineness

Per cent of residue on 100 sieve #200 sieve	1.8	13.2
--	-----	------



Per cent of water used 21

Specific gravity 3.10

A sand test proportioned 1 to 3 by weight showed:

Tensile strength

in lbs. per square inch

<u>7 days</u>	<u>28 days</u>
387	420

9.5 per cent of water used.

Reinforcing Bars:- The reinforcement was square corrugated bars 1/2" - 3/4" and 1" sizes, varying in shipping lengths from 6' to 40'.

These were shipped from the main line via Plummer and Spokane to Spokane Bridge and from there hauled by team to the yards.

In the yards the bars were sorted and cut to the various plan lengths. They were then taken to the blacksmith shop and bent into the required shape as they were needed in the work.

The following list shows the amount of reinforcing material used in the work:

East Abutment

Size	1/2"	3/4"	1"	Total
Lin.Ft.	6167	6544	3285	15996
Lbs.	5242	12519	11169	28930

1. A semi test proportioned 1 to 3 by weight showed:
 Specific Gravity 2.10
 Air content of water used 12

tensile strength
 in lbs. per square inch

7 days	28 days
387	420

9.2 per cent of water used.

Reinforcing Bars:- The reinforcement was generally
 corrugated bars 1/2" - 3/4" and 1" sizes, varying in
 varying lengths from 6' to 40'.
 These were shipped from the main line via Thurston
 and Spokane to Spokane Bridge and from there hauled by
 team to the yards.
 In the yards the bars were sorted and cut to the
 various plan lengths. They were then taken to the
 blacksmith shop and bent into the required shape as
 they were needed in the work.
 The following list shows the amount of reinforcing

the material used in the work:

Reinforcement

Size	1/2"	3/4"	1"	Total
Lbs.	2242	11212	11162	24616
Sq. Ft.	217	2214	3282	13793

West Abutment

Size	1/2"	3/4"	1"	Total
Lin.ft.	14391	9817	10998	35206
Lbs.	12232	18780	37393	68405

Timber, Lumber and Piling:- The timbers used in the work trestle and upon various structures as mixer platform, gravel washer, etc., were old bridge timbers shipped to Spokane Bridge from the main line yards and hauled to the work by team.

The contractors used 45956 feet B.M. of this material, not including the timber in the temporary trestle. Of this 34660 feet B.M. was recovered upon the completion of the work and sent into the old material supply again. The remainder was either lost in the river, or cut into such lengths as were not acceptable for further use.

The form lumber and caisson timber was shipped via the Inland Empire System to Spokane Bridge from a local mill in Coeur d'Alene. That which was left at the end of the work was sent into the railway company's old material stock.

Approximately 135000 feet B.M. of small dimensioned stock was used for forms, cofferdam, sheds, etc. The amount used in the caissons for Piers #1 and #2 was about

Summary

Year	1921	1922	1923	Total
1921	10000	15000	18000	43000
1922	12000	18000	22000	52000
1923	15000	20000	25000	60000

Timber, Lumber and Milling: - The timber used in the
 mill, and upon various structures as water pipes,
 form, gravel washer, etc., were all shipped from
 the Spokane Bridge from the main line yards and
 the work by team.

The contractors used 42000 feet of this material
 in building the timber in the temporary structure.
 This material was recovered upon the completion of
 the work and sent into the old material stock.
 The remainder was either lost in the river, or was
 such lengths as were not acceptable for further use.
 The form lumber and certain other was shipped to
 the Island Bridge system to Spokane Bridge from a local
 mill in Coeur d'Alene. That which was left at the
 of the work was sent into the railway company's
 material stock.

Approximately 12000 feet of well dimensioned
 stock was used for form, water pipes, etc. The
 amount used in the various structures at the Island



Spokane River Bridge
 Drilled piles for Pier 2 from NW Pier
 4. 13 Oct 9, 1910

5

61900 F.B.M. From these two items approximately 17900 F.B.M. were returned to old material stock. The form lumber was 2 x 8 stock, with 3 x 12 planks for flooring, runways, etc, and 3 x 8 M. and D. material for sheeting.

The piling also came from Coeur d'Alene and was unloaded on the old main line of the Inland Empire System opposite the work. From there it was brought to the work by team as needed.

The switching charges by the Inland Empire System for the use of the main line were a minimum of \$5.00 for one hour. Unloading there was a great saving as two cars came in at once and could be unloaded in an hour, saving a long team haul and providing a storage yard on the Inland Empire System right of way.

10000 lin.ft. of piling was used. The piles were fir and tamarack of 20 - 25 - and 32 foot lengths. At the completion of the work the pile cut offs were sent into the old material stock to be used for building foundations and fuel.

Miscellaneous:- Such items as nails, oil, waste, small tools, etc., ordered from time to time on the work, were shipped from dealers in Spokane via the Inland Empire System to Spokane Bridge by local freight or express.

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The following list shows the amount of nails, oil, bolts, etc. used during the course of construction:

Article	Amount
Coal from Bellview, B.C.	160 tons
Drift bolts	2100
10 d nails	20 kegs
60 d nails	8 "
40 d "	6 "
16 d "	17 "
20 d "	2 "
8 d "	1 "
3/8" x 8" boat spikes	6 "
3/8" x 3" track spikes	50 lbs.
Nuts and washers	65 "
Tool steel and iron	1450 "
Packing	33 "
Mill brooms	1 doz.
8" files	18
Tarred felt	8 rolls
Waste	1 bale
Blacksmith coal	6 sacks
Oakum	50 lbs.
White lead	25 "
Boiler compound	10 gals.
#16 Annealed wire	12 rolls
9 " "	17 "
Coal oil	1 drum
Lubricating and cylinder oil	50 gals.
Cup grease	20 lbs.

The above list does not include iron washers and bolts ordered on engineer's requisition, or that shown on plan bills of material.

All material was ordered by the contractors at the direction of the engineer in charge and bills rendered at the end of the month. The only exception to this

being the cement, reinforcing bars and old timber which were ordered on requisition of the Division Engineer.

Labor:- The labor on this work was furnished by the contractors as stated in the contract. A specimen of the daily force report on page 27 shows the average force on the work.

These reports were sent to the office of the Division Engineer and to the main office of the contractors upon the completion of each day's work. By this method a daily report of the progress of the work was always on record and in determining the cost of the various parts of the work was absolutely necessary.

Distributions for all the work done were kept in this way being classified for each separate pier or abutment and also for general work as gravel, cement handling, bridge protection, rip rap, etc.

The superintendence of the work for the contractors was done by a general superintendent who made occasional trips to the work, but was not resident there. During his absence a general foreman had entire charge, but was always subject to the orders of the engineer on the work.

The wages paid for the various classes of labor is shown in the specimen report. These were constant throughout, with the exception of the wages for common

Bates & Rogers Construction Co.

355 Dearborn Street, Chicago.

DAILY REPORT.

P. O. ADDRESS... Box 17

BRIDGE Spokane... DATE, Oct. 31... 1910

WORK DONE:	COST LABOR.
<u>East</u> <small>ABUTMENT</small> EXCAVATION _____ CU. YDS.	<u>4</u> <u>50</u>
<u>Pier #2</u> " CONCRETING _____ CU. YDS.	<u>21</u> <u>97</u>
<u>West</u> " FORMS _____	<u>43</u> <u>86</u>
<u>Pier #2</u> " _____	<u>14</u> <u>05</u>
<u>Pier #1</u> PILES DRIVEN NO. <u>7</u> LIN. FT. <u>224</u>	<u>23</u> <u>23</u>
Hauling Lumber	<u>7</u> <u>50</u>
Reinforcing W. Abut.	<u>7</u> <u>30</u>
Gravel	<u>35</u> <u>34</u>
	<u>\$157</u> <u>75</u>

FORCE:			
<u>1</u> FOREMEN	@ \$ <u>125⁰⁰</u>	PER Mo.	<u>4</u> <u>03</u>
<u>3</u> ENGINEERS	" \$ <u>3⁵⁰</u>	PER DAY.	<u>10</u> <u>50</u>
<u>12</u> CARPENTERS	" \$ <u>"</u>	"	<u>42</u> <u>00</u>
<u>1</u> " 4 man.	" \$ <u>4⁰⁰</u>	"	<u>4</u> <u>00</u>
<u>4</u> LABORERS	" \$ <u>2⁵⁰</u>	"	<u>10</u> <u>00</u>
<u>26</u> "	" \$ <u>2²⁵</u>	"	<u>58</u> <u>50</u>
<u>1</u> Blacksmith	" \$ <u>3⁵⁰</u>	"	<u>3</u> <u>50</u>
<u>1</u> TIMEKEEPERS	" \$ <u>75⁰⁰</u>	" Mo.	<u>2</u> <u>42</u>
<u>2.8</u> TEAMS & Men	" \$ <u>6⁰⁰</u>	" day	<u>16</u> <u>80</u>
<u>1</u> Rigger	" \$ <u>3⁰⁰</u>	"	<u>3</u> <u>00</u>
<u>1</u> Engineer	" \$ <u>3⁰⁰</u>	"	<u>3</u> <u>00</u>
	" \$ _____	"	

NO. SACKS CEMENT USED _____ \$157 75

EXPECT TO COMPLETE THIS JOB _____ 191 _____

REMARKS: 18 yds. of sand delivered
90 yds. of gravel hauled
Average penetration Pier #1 piling 17.1 ft

WEATHER: Clear _____ C. H. Smith
 FOREMAN.

laborers, which were cut from 25 cents per hour to 22 1/2 cents and finally to 20. Exceptionally good men of this class were paid in a like proportion 27 1/2 - 25 and 22 1/2 cents per hour.

The largest force on the work at one time consisted of the following:

- 1 General Foreman
- 1 Carpenter "
- 1 Pile driver "
- 4 Engineers
- 10 Carpenters
- 4 Carpenter helpers
- 1 Blacksmith
- 2 Riggers, or pile driver men
- 1 Timekeeper
- 3 Teams
- 1 Single horse and man
- 51 Laborers

For a time during the driving of piling for foundations a pile driver foreman was on the pay roll for 40 cents per hour. This was only a temporary expense, as the general foreman and carpenter foreman were ample to direct the work other than pile driving where supervision

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- I. General
- II. Specific
- III. Details
- IV. Summary
- V. Conclusion
- VI. Appendix
- VII. References
- VIII. Index
- IX. Glossary
- X. Notes
- XI. Bibliography
- XII. Acknowledgments
- XIII. Foreword
- XIV. Introduction
- XV. Chapter 1
- XVI. Chapter 2
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- XX. Chapter 6
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- XXV. Chapter 11
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- XXVII. Chapter 13
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- XXX. Chapter 16
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- XL. Chapter 26
- XLI. Chapter 27
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- LXX. Chapter 46
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- LXXXXXXI. Chapter 87
- LXXXXXXII. Chapter 88
- LXXXXXXIII. Chapter 89
- LXXXXXXIV. Chapter 90
- LXXXXXXV. Chapter 91
- LXXXXXXVI. Chapter 92
- LXXXXXXVII. Chapter 93
- LXXXXXXVIII. Chapter 94
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- LXXXXXXXI. Chapter 97
- LXXXXXXXII. Chapter 98
- LXXXXXXXIII. Chapter 99
- LXXXXXXXIV. Chapter 100

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must be constant.

Construction-Concrete Sub-structure:- The construction work will be discussed in the actual order of its progress and not for each abutment and pier separately. This is done because the work did not proceed in the direct order of Piers #1, #2 and #3, but often two or more pieces of work were in progress at one time.

Before the permanent bridge work was commenced, it was deemed necessary to construct a temporary timber trestle to be used for traffic in the event of the non-completion of the permanent bridge at the time track was to be laid. This temporary structure was built and complete before the bridge contractors were ready to work.

In order to have an advantageous means of carrying on the work, it was deemed advisable to build a temporary work trestle to transport concrete on and also for the use of the pile driver. This was therefore started at once. Twenty-one 3 pile bents were driven and decked with old bridge timbers. The piling used were 20 x 25 ft. lengths.

While the temporary trestle was under construction, the timbers for the cofferdam for Pier #3 were being framed and put in place. This cofferdam was 14' x 45' inside of the sheeting. The method of construction was:

Construction - Concrete - Retaining Wall

The work will be done in the order of the program and not for each segment and later segments.

This is done because the work did not proceed in the correct order of tiers 1, 2 and 3, but often the

more pieces of work were in progress at one time.

Before the permanent bridge work was completed, it

was deemed necessary to construct a temporary trestle

to be used for traffic in the event of the

completion of the permanent bridge at the time track was

to be laid. This temporary structure was built and

complete before the bridge contractors were ready to start.

In order to have an advantageous means of carrying

on the work, it was deemed advisable to build a temporary

work trestle to transport concrete on and also for the use

of the pile driver. This was therefore started at once.

Twenty-one 3 pile bents were driven and located with 60

bridge timbers. The piling used was 20 ft. long.

While the temporary trestle was under construction,

the timbers for the cofferdam for tier 3 were being

laid and put in place. This cofferdam was 14 ft. wide

inside of the sheeting. The method of construction was



Four 12 x 12 timbers were fastened together in the form of a rectangle and floated into the desired position, being held in place by lines and bracing to temporary work. The sheeting, 3 x 8 M. & D. material, was then put in place around this waling, being held at intervals by small nails. When the entire waling was walled up with sheeting a similar waling was built on the outside, about two feet distant all around on three sides, the west side being in such shallow water that outside protection was not necessary, the puddling material being placed up against the sheeting with no backing.

When this second frame was made it was walled up on the inside with 3 x 12 rough lumber. The puddling material, local surface dirt, was then dumped in between these two walls. The puddling process being completed the inside was pumped out and the leaks tamped tight.

The excavation was next started. This was done by hand, the material being loaded into bottom dump buckets, which were handled by a stiff leg derrick situated at (2) near Pier #3 (map page 11) the material being deposited around the cofferdam.

The waling and sheeting were driven down by hand operated tamps. When down about six feet a second waling was built of the same dimension as the first

form of a rectangle and floated into the desired position, being held in place by lines and bracing to temporarily support the sheet piling. The sheet piling, 3 x 8 ft. material, was then put in place around the cofferdam, being held at intervals by small nails. Then the entire walling was walked up with sheet piling a similar walling was built on the outside, about two feet distant all around on the same side, the west side being in such shallow water that outside protection was not necessary, the piling material being placed up against the sheet piling with no backing.

Then this second line was also installed on the inside with 3 x 12 rough lumber. The bracing material, local surface dirt, was then dug in between these two walls. The piling process being completed the inside was pumped out and the locks tamped tight. The excavation was next started. This was done by hand, the material being loaded into bottom dump trucks which were handled by a still leg derrick situated near the top (see page 11) the material being dumped around the cofferdam.

The walling and sheet piling were driven down by operated tamps. Then down about six feet a second walling was built of the same dimension as the first



and put in place about five feet above it. This method of driving sheeting and excavating was then continued until the desired level was obtained in the cofferdam.

A 5" Emerson pump was used in this cofferdam and proved of ample capacity, although the leakage was considerable at times. This was the only wet excavation on the work.

During the cofferdam work the boiler was put in place as shown on map, the gravel washer built and track laid from it to the storage yard, the mixer platform was built and the mixer set up, the tool house and blacksmith shop were built and excavation started on the west abutment.

By the time the excavation in the cofferdam was completed the work trestle was also finished and the pile driver was returned to Pier #3 site ready for driving the foundation piling in the cofferdam. This foundation consisted of 88 - 20 and 25 ft. piles driven every 2' 3" along the center line of the pier and every 2' 6" at right angles to it.

The piles were driven until they practically stopped, or to an average penetration of 10.2 ft. The cofferdam was allowed to fill during the pile driving and was pumped out after all the piles were driven. They were

... to the level of the ...
... the desired level was obtained in the ...
... 3" person was used in this ...
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... This was the only set ...
... the work.

During the ... were the ...
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... it to the storage yard, the ...
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... pile driver was returned to ...
... ing the foundation piling in the ...
... tion consisted of 22 - 20 and 22 ...
... 3" along the center line of the ...
... at right angles to it.

The piles were driven until they ...
... to an average penetration of 10.0 ...
... was allowed to fill ...
... all the piles ...

then cut off, by hand, about 1.5 ft. above the ground. A small box was made to carry the water around the sides of the cofferdam to the pump in one corner and everything was in readiness for concrete.

During the process of pile driving at Pier #3 forms were being cut for the nose and back, material delivered and the river bed at Pier #2 site raked with an iron hook to remove large surface boulders.

The pile driver was moved to Pier #2 and 93 - 32 ft. piles were driven every 2' 6" along the center line and every 3 ft. at right angles to it. These were also driven to an approximate stand still, to a penetration of 18.9 ft. During this pile driving Pier #3 was concreted. The concrete being placed with bottom dump buckets which were handled by the derrick at (2).

In the meantime the excavation for the west abutment was continued and construction started on the caisson work for Pier #2. This caisson consisted of three tiers of 12 x 12 S. 1. S. timber bolted together, making a solid base 14 x 48 x 3 ft. On this the side and end walls made of 3 x 12 M. & D. material were fastened by long hook bolts running from the top sill to the base. They were fastened together at the ends by bolts so that when they were used at Pier #2

... of the concrete for concrete.

During the process of pile driving at Pier 2, the piles were being cut for the nose and back, material delivered and the river bed at Pier 2 site raised with an iron hammer to remove large surface boulders.

The pile driver was moved to Pier 2 and 3 - 27. Piles were driven every 2' 6" along the center line and every 2 ft. at right angles to it. These were driven to an approximate stand still, to a penetration

of 16.2 ft. During this pile driving Pier 2 was completed. The concrete being placed with bottom form brackets which were handled by the derrick at Pier 2. In the meantime the excavation for the west pier

work was continued and construction started on the eastern work for Pier 2. This eastern consisted of three tiers of 12 x 12 x 12 ft. timber piles to be driven a solid base 14 x 14 x 3 ft. On top the piles

and all walls made of 3 x 12 x 12 ft. material were fastened by large metal bolts running from the top wall to the base. They were fastened together at the base by bolts so that when they were used at Pier 2



Getting in pier 2 to place
 driving pile for pier
 Spokane Falls Bridge Oct. 25, 1910 L 83 10

the bolts were removed and the sides and ends came off and were floated into place and set up again on the base for Pier #1.

While waiting for the forms to be placed for the neatwork of Pier #3 the excavation for the main part of the West Abutment was finished and the footing concreted. The concrete was deposited by cars running on a track from the mixer to the foundation.

The pile driving at Pier #2 being finished the driver was moved to Pier #1 site, which had been previously raked for boulders, and 94 - 32 ft. piles were driven here. These piles were spaced the same as for Pier #2 and were driven until the movement under last blow of hammer with fall of 20 ft. was less than an inch. The average penetration was 17.8 ft.

While the pile driver was working at Pier #1 the forms for the neatwork of the West Abutment were being made, Pier #3 was stripped, the rip rap work around Pier #3 was started after the cofferdam sheeting had been pulled, the guy derrick at (1) was set up and the engine moved from (2) near Pier #3 to operate it and the piling at Pier #2 were cut off.

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Pier 3 completed
Grillage for Pier 4 photo by
Spokane River Bridge Oct 20 1910 1-14

The piling were cut off under water with a circular saw on a vertical shaft. This shaft was mounted on a frame that held the engine and was operated by a belt. Skidways were fastened to the temporary trestle and guide piling and rails were placed on them to an exact level. The saw was set to cut over the highest point of rock on the bottom and held in place by a collar on the shaft. A steam line was laid from the boiler to the saw engine and connection made with steam hose.

The cutting was started at the up stream end of the pier and the frame was skidded back and forth at right angles to the center line of the pier being fed ahead as each row of piling was cut. The levels of the cut offs were frequently checked and the saw re-set if necessary. After all the piles were cut a variation in level of only .03 ft. was found.

When the piles were cut and the skidways and saw frame removed, the work trestle was opened and the completed caisson was floated into place. It was lined in and when in position was secured by bracing to the temporary structure and the guide piles.

During this work the pile driving at Pier #1 was completed and the saw was moved to cut the piling there in the method previously described. The pile driver was then taken apart and the engine of the pile driver used on the stiff leg derrick, which was set up at (2)





The rip rap work at Pier #3 was completed also, the concreting of the main West Abutment and some rip rap was placed in front of the main east abutment site. The footing pedestals for the west abutment were excavated and all concreted with the exception of those for the future track.

The concrete was next placed in the caisson at Pier #2. It was carried from the mixer in buckets on cars and then hoisted by the derrick into the caisson where it was distributed evenly to prevent undue settling at any one place during the process of sinking. The caisson being calked and water tight there was no trouble in working the concrete.

When the caisson was sunk onto the piling, being reset for alignment just before it was completely down, the footing was allowed to set up before the forms for the neatwork were put in place. As much of the form work as could be saved from Pier #3 was used as the shafts of all three piers were of the same dimension making the forms interchangeable.

During the concreting of Pier #2 the forms for the columns of the west abutment were placed, the reinforcing bars were cut and bent, the caisson base for Pier #1 was made, and the excavation for the main east

The first part of the report is a description of the work done during the last year. It is divided into two main parts, the first of which is a general account of the work done during the year, and the second is a more detailed account of the work done during the last six months. The first part is divided into three sections, the first of which is a general account of the work done during the year, and the second is a more detailed account of the work done during the last six months. The second part is divided into two sections, the first of which is a general account of the work done during the last six months, and the second is a more detailed account of the work done during the last six months.

The second part of the report is a description of the work done during the last six months. It is divided into two main parts, the first of which is a general account of the work done during the last six months, and the second is a more detailed account of the work done during the last six months. The first part is divided into three sections, the first of which is a general account of the work done during the last six months, and the second is a more detailed account of the work done during the last six months. The second part is divided into two sections, the first of which is a general account of the work done during the last six months, and the second is a more detailed account of the work done during the last six months.

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New York, N.Y. Mill. Br. over S. River

abutment started. The gravel was also delivered during this time and the washer and track taken up.

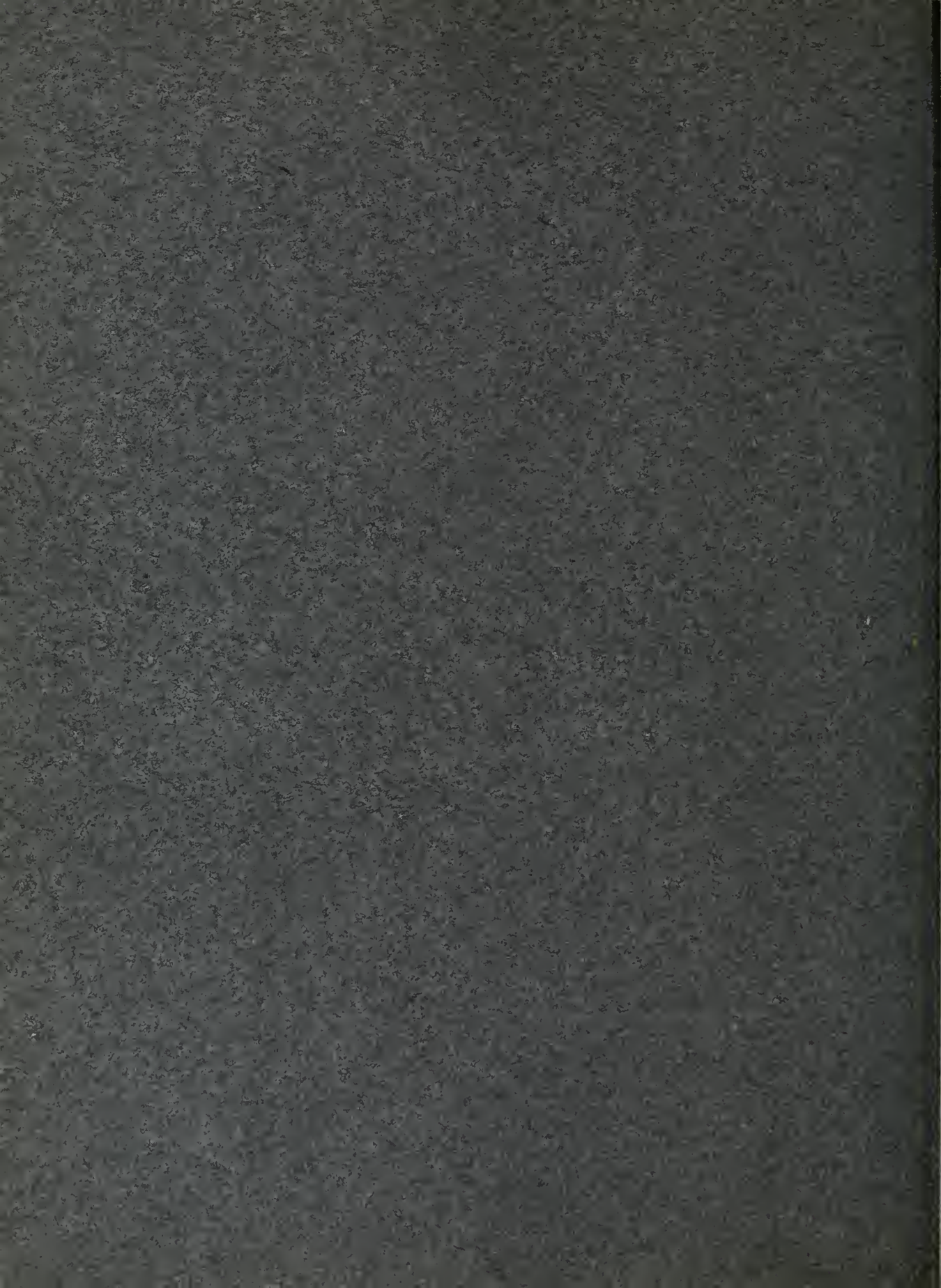
The excavation for the east abutment was attended with some difficulties. The material was coarse gravel and sloughed off considerably, breaking back so far in the main abutment site as to endanger the temporary trestle, which had to be jacked up and repaired with a cribbing under it. The excavation for the footing pedestals were very deep to prevent slipping on the side hill and for this work dry cofferdams had to be built to hold back the dirt on the sides of the excavations. Interference with the temporary trestle also caused more cribbing to be done to maintain that structure.

The west abutment approach was next concreted. The mixture for this work was made very wet and was thoroughly worked by spades against the face, every effort being made to get a good surface and not expose the rods which were within two inches of the forms. The work of spading in the columns was exceedingly difficult as the rods in place left very little room for a man to work and it was necessary for him to move out whenever a car of concrete was dumped.

The concrete for the west abutment was emptied into buckets at the mixer, which were raised by the derrick at

The excavation for the east apartment was attended with some difficulties. The material was coarse gravel and sloughed off considerably, breaking back so far in the main apartment site as to endanger the temporary trestle, which had to be jacked up and repaired with cribbing under it. The excavation for the footing pedestals were very deep to prevent slipping on the side hill and for this work dry coffers had to be built to hold back the dirt on the sides of the excavation. Interference with the temporary trestle also caused some cribbing to be done to maintain that structure. The west apartment approach was next completed. The mixture for this work was made very wet and was tamped by hand against the face, every effort being made to get a good surface and not expose the rough side were within two inches of the forms. The work of spreading in the columns was exceedingly difficult as the main place left very little room for a man to work and it was necessary for him to move out whenever a cast of concrete was finished. The concrete for the west apartment was applied in concrete at the mixer, which were raised by the bar bed





(1) and dumped on a platform on the temporary trestle. From here it was shoveled into a side dump car and conveyed to the place where it was to be used. For concreting the columns it was shoveled into chutes that ran down into the structure. For the side walls and cross beams it was dumped on a platform and shoveled directly into the work. Great care at all times was observed in the placing of this concrete not to disturb the reinforcement.

When the concreting was completed at Pier #2 the derrick and engine were removed to (2) Pier #1 to be used on concreting this Pier. It was then decided to place the caisson for Pier #1, but before this was done the gates of a large dam at Post Falls, Idaho were opened and the water rose four feet bringing all manner of drift with it.

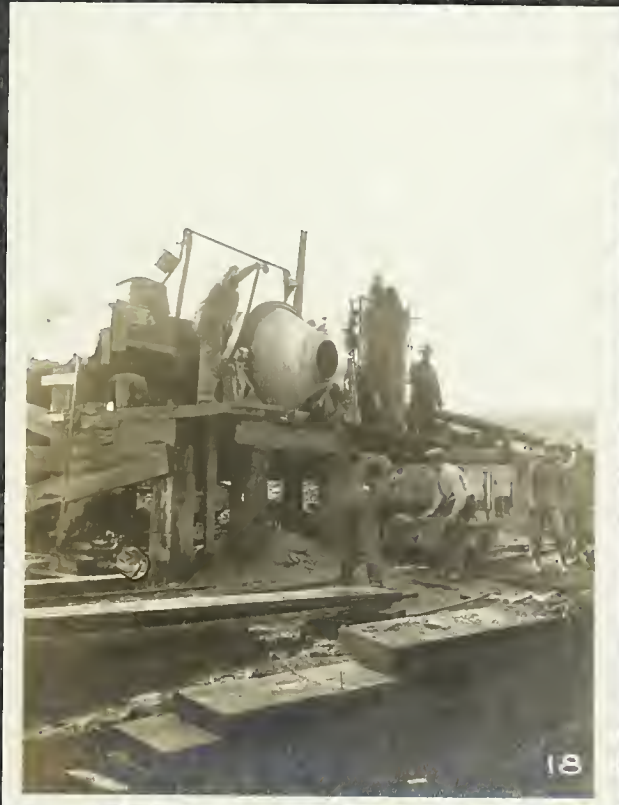
So great was the accumulation of drift that both the work and temporary trestles were in danger. This called for the entire labor force to keep an open channel and send the accumulated drift down the river. This condition prevailed for 12 days, but at the end of this time, although no further inconvenience was caused by drift, the water did not go down more than one half foot, making it inadvisable to place the Pier #1 caisson as it

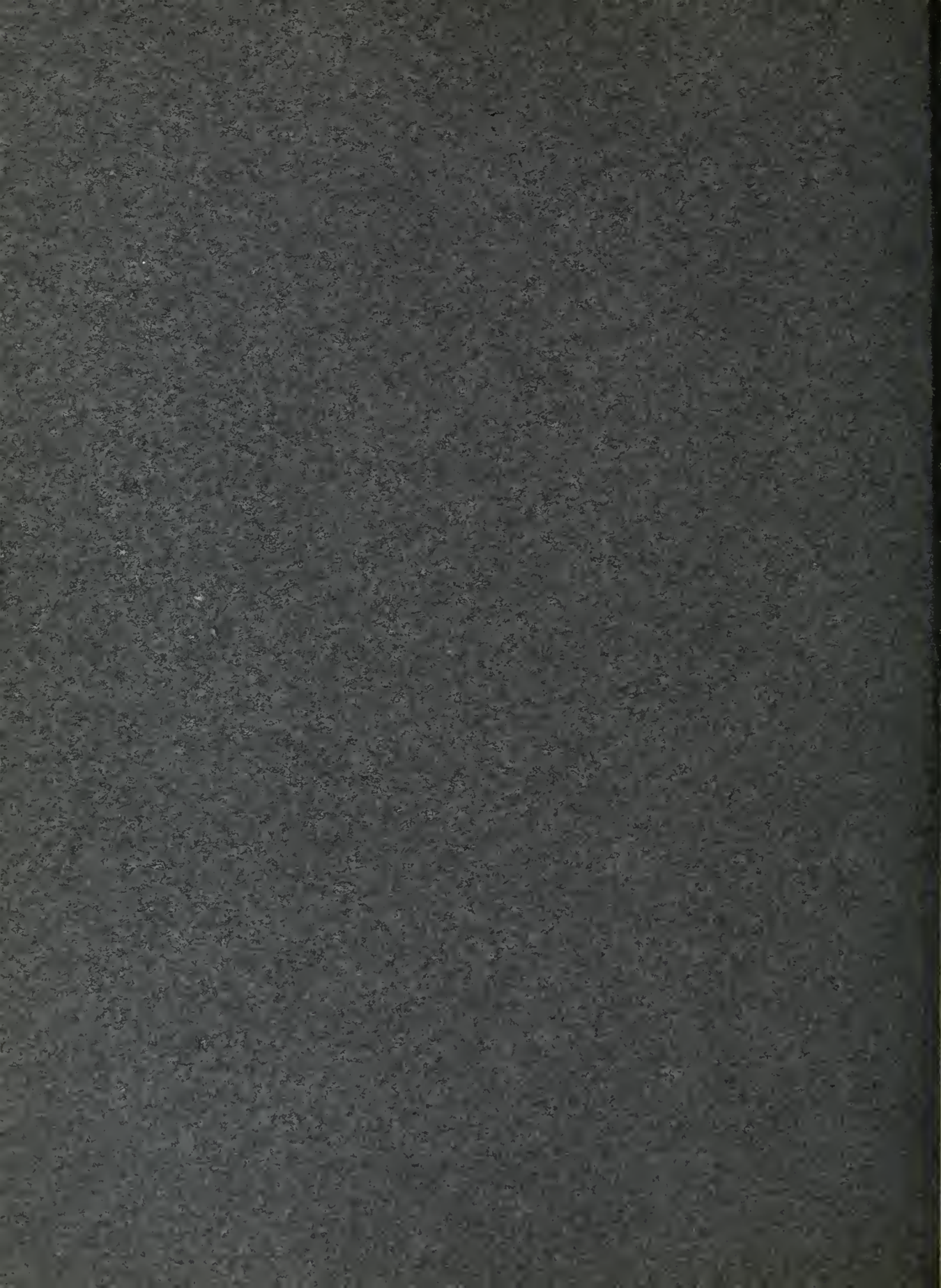
(2) The concrete was placed on the ...

From here it was shoveled into a side dump car and conveyed to the place where it was to be used. ... For the side walls and ... it was dumped on a platform and shoveled directly into the work. Great care at all times was observed in the placing of this concrete not to disturb the reinforcement.

When the concrete was completed at Pier 1 the derrick and engine were moved to Pier 2 to be used on concreting this pier. ... but before this was done the gates of a large dam at East Falls, Idaho were opened and the water rose four feet bringing ... at drift with it.

So great was the accumulation of drift that the work and temporary trestles were in danger. ... called for the entire labor force to keep an open channel and send the accumulated drift down the river. ... condition prevailed for 12 days, but at the end of this time, although no further inconvenience was caused by drift, the water did not go down more than one foot ... it is undesirable to place the pier 1 ...





might have broken its moorings or got ^{ten} something under it, due to the current, that would have prevented it from sinking to a level footing.

The labor force was increased at this time and the concrete work on the west abutment was completed. The footings for the main east abutment were also concreted. The concrete for this work was carried across the work trestle in push dump cars and emptied directly onto the work. The engine at Pier #1 was rigged to help the cars up an incline at the east end of the work trestle.

While the concreting of the east abutment was under way, track was laid across the temporary structure and as daily work trains were in operation it was necessary to arrange for a rapid means of clearing the track on the bridge. Therefore the platform used on the west abutment work was arranged so that it was not fastened to the structure, but could be lifted off with the derrick, to which a long boom was attached to handle the concrete for the east abutment.

All the concrete with the exception of the main abutment footings on the east abutment, both plain and reinforced, was placed by push cars on the temporary trestle, the concrete being deposited in chutes which were

...the main structure, that would have prevented it from

standing to a level footing.

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work. The engine at later, I was rigged to help the

cars up an incline at the east end of the work trestle.

While the concreting of the east abutment was in progress

the track was laid across the temporary structure and

several work trains were in operation it was necessary

to arrange for a rapid means of clearing the track at

the bridge. Therefore the platform was on the west

abutment work was arranged so that it was not necessary

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to which a long boom was attached to handle the concrete

for the east abutment.

All the concrete with the exception of the main

abutment footings on the east abutment, both plain and

reinforced, was placed by push cars on the temporary

trestle, the concrete being deposited in dump cars which were



shortened as necessary. The side walls and cross beams were concreted from a platform similar to that used on the west side.

Shortly after track was laid the water fell considerably and it was deemed advisable to place the caisson for Pier #1. To protect the caisson from any small amount of drift that might be a menace to the work, a boom was placed in front of the Pier site after the caisson was placed.

The concreting of Pier #1 was handled in a manner similar to that used at Pier #2. This work was rapidly done, as the bridge crew were waiting to place the steel and some time was necessary for the concrete to set before it was advisable to put any weight on it. The erection of the steel will be discussed later.

During the concreting of the east abutment and the time forms were being built for Pier #1, the rip rap work was going on at Pier #2. This rip rap consisted of surface boulders picked up on the land surrounding the work, by permission of the owner, loaded on teams and hauled to the west end of the work trestle, here it was loaded on a push car and taken to its destination. This work was done whenever the laborers were not needed on concreting and during the general clearing up.

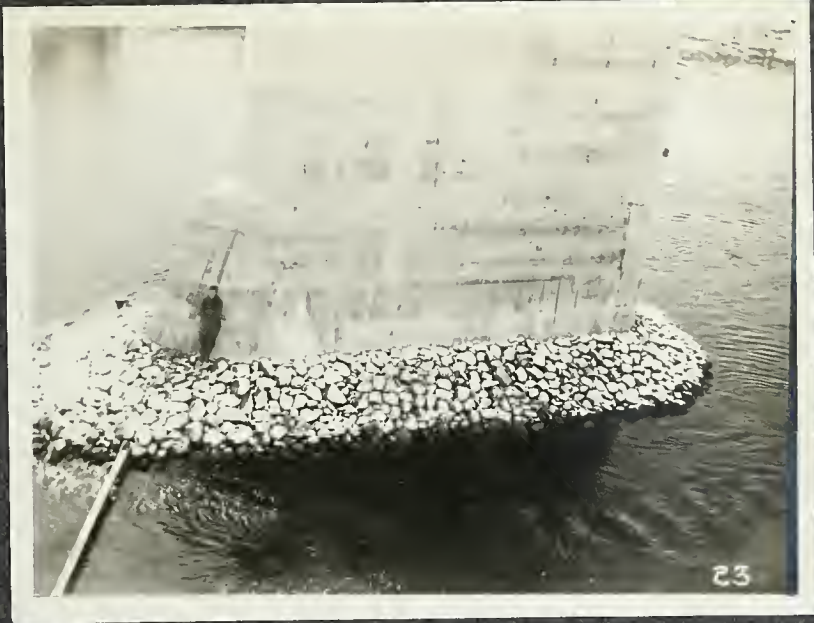
... on the side ...
... platform ...
... the west side.

Shortly after truck was laid the water ...
... and it was deemed advisable to place the
... To protect the ...
... amount of lift that ...
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... was fixed.

The concreting of tier 1 was handled in a ...
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... to place the steel
... and some time was necessary for the concrete to set ...
... it was advisable to put any weight on it. The
... of the steel will be discussed later.

During the concreting of the east abutment ...
... for tier 1, the ...
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... of the ...
... of the work ...
... to the ...
... the laborers were not needed ...
... the general clearing up.





At about this time the future track footings for both the east and west abutments were placed, as it was desired to use the site for storage of the deck slabs.

The deck slabs were concreted in forms placed on specially constructed platforms to the south of the west abutment and between it and the sand pile. These were allowed to set for at least ten days and were then moved by the derrick (1) and piled up close to the west abutment for the derrick car to pick up readily when placing. All the slabs were made with two bars placed in them in the form of a U, making a place for hooks to be attached in handling.

When all the concrete had been placed, the work of making the roads at the east and west abutments was begun. This was done with slip teams and hand shoveling, the material being dumped off of flat cars by a Lidgerwood plow. These cars were in use in the track surfacing and the gravel was loaded into them by a steam shovel in a cut about one half mile from the bridge.

While the roadways were being made the rip rap work was finished and the yard cleaned up. All the material to be returned to stock was piled up to the south of the west abutment within reach of the guy derrick (1).

The contractors equipment was hauled up on the right of way

At about this time the west and east
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by the derrick (1) and piled up close to the west abutment
for the derrick car to pick up readily when placed.
All the slabs were made with the same placed in them in
the form of a U, leaving a place for holes to be drilled
in finishing.

When all the concrete had been placed, the
during the work at the east and west abutments was
began. This was done with the tower and was
the material being dumped off of that side of
the road level. There were no piles in the
underneath and the gravel was loaded into the
level in a cut about one half mile from the bridge.
While the roadways were being made the site was
was finished and the work of the
to be returned to about the middle of the
went almost within reach of the derrick (1).
The contractor's equipment was parked up on the



opposite the town of Spokane Bridge to be stored until needed again.

The temporary work trestle was pulled out by the engine at (1), it being moved for this work over where the boiler had been. A block was fastened to a tree on the east bank and the cable with a chain on it stretched across. One drum of the engine was used to pull the chain out and the other to return it. Beginning at the west end by this means all the work trestle was pulled ashore and the salvaged material was piled up with the other old stock.

Upon the completion of all the clearing up and storing of material a work train was furnished and loaded by means of guy derrick. All the material thus loaded was shipped to Dishman and turned into the second hand stock. The ground was leveled off with slip teams and the site was left in good order with no unsightly rubbish lying around to mar the appearance of a very sightly structure.

A reference to the cost sheet in the appendix gives all the information in regard to the yardage, mixtures, and various distributions.

The work was commenced on August 29, 1910 and completed on Feb. 6, 1911. Stormy weather interfered with

The temporary work trestle was pulled
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stock. The ground was leveled off with slip teams and
the site was left in good order with no unsightly
lying around to mar the appearance of a very slight
structure.

A reference to the cost sheet in the appendix gives
all the information in regard to the yardage, material, and
various distributions.

The work was commenced on August 29, 1910 and com-
pleted on Feb. 6, 1911. Stormy weather interfered with



the work on 5 days, a very small percentage. Concrete was actually placed on 56 days. One accident due to the carelessness of a gang foreman in dropping a heavy block on his foot was the only one of consequence during the entire work.

The present temporary trestle made it impossible to run the center line of the track so the line was off set and run in front of the piers. The piers were at an angle of 60 degrees with the center line and were lined in from points set on the old Inland Empire System bridge. Vibration and rough usage made it impossible to use the temporary trestle for permanent sights.

No forms were used in the bottom footings in any of the work. The footings of the piers were placed against the caissons and for all the abutment pedestals they were put in place in the excavation without form work.

Upon the completion of the work full details of yardage, mixture, materials and all matters of importance during the construction and bearing on future work were recorded on blue prints and sent to the office of the Chief Engineer.

The plans were made in Chicago, under the direction of C. F. Loweth and the construction was handled under Division Engineer A. G. Holt, in Spokane. The writer

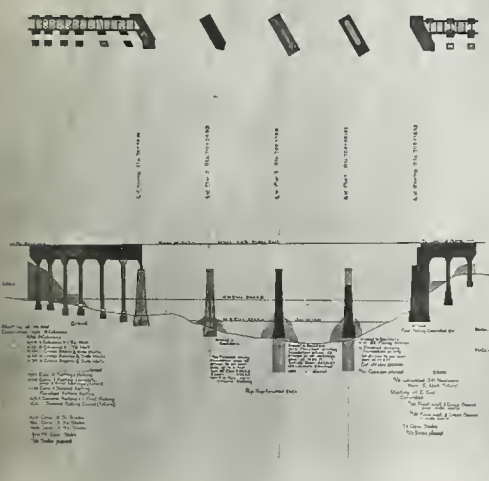
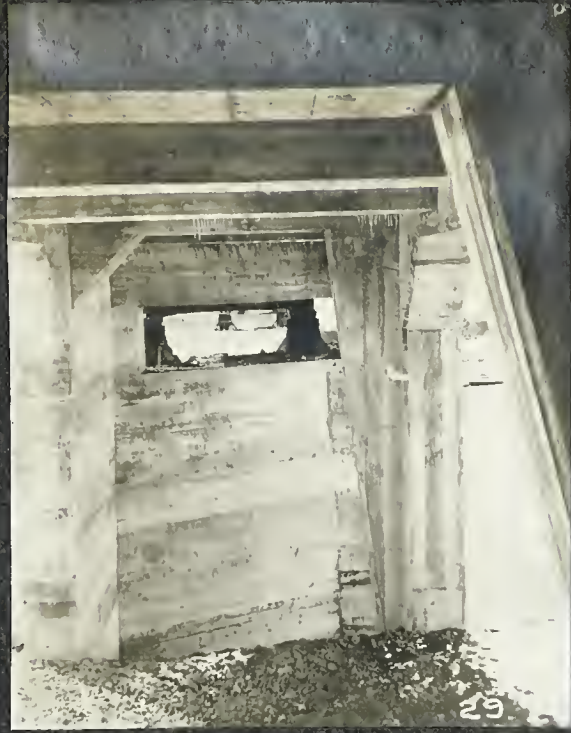
The work on 3 days, a very small percentage
was actually placed on 26 days. One accident due to the
carelessness of a gang foreman in dropping a heavy block
on his foot was the only one of consequence during the
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The present temporary trestle made it impossible to
run the center line of the track as the line was off set
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IDAHO & WESTERN R.
Progress Profile
 of
Concrete Work
 Spokane River Crossing of
SPOKANE BRIDGE
 WASH.

Office of the Chief Engineer
 Spokane, Wash.
 June 22, 1911

Station	Contract	Contract	Contract	Contract	Contract	Contract
1+00	1000	1000	1000	1000	1000	1000
2+00	2000	2000	2000	2000	2000	2000
3+00	3000	3000	3000	3000	3000	3000
4+00	4000	4000	4000	4000	4000	4000
5+00	5000	5000	5000	5000	5000	5000
6+00	6000	6000	6000	6000	6000	6000
7+00	7000	7000	7000	7000	7000	7000
8+00	8000	8000	8000	8000	8000	8000
9+00	9000	9000	9000	9000	9000	9000
10+00	10000	10000	10000	10000	10000	10000



was the engineer in charge of the work in the field.

For diplomatic reasons it is not deemed necessary to go into the details of the cost of the work, although the cost sheet is shown in the appendix.

Steel:- The steel work consists of four 80 foot girders, 3 of them 9' 6 1/2" deep, made by the railway company for this bridge and one 8' 5 1/2" deep made originally for a main line bridge, but used on this work to economize.

The shallow girder was originally a right angle girder and was delivered as such. The necessary work to change it to a 60 degree skew, being done in the yard at the bridge. This girder was placed at the east end.

The method of erecting the steel will be briefly described. The equipment consisted of two 30 ton derrick cars, with 50 ft. boom, one compressor car, tool cars and the necessary boarding cars for a crew of 30 men, only 12 of these being steel workers.

Girders were brought out on a temporary trestle, on two flat cars with a derrick car on each end. They were then lowered to rest on the second track portion of the piers and a temporary bent at the abutments.

The bents of the temporary trestle were then pukled out down to the caps on the piles. The bed plates were

... engineer in charge of the work is ...
... diplomatic reasons it is not deemed necessary
... into the details of the cost of the work, ...

... the cost sheet is shown in the appendix.

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to change it to a 60 degree skew, being done in the field
at the bridge. This girder was placed at the east end.

The method of erecting the steel will be briefly
described. The equipment consisted of two 50 ton
derrick cars, with 50 ft. boom, one compressor car,
tool cars and the necessary boarding cars for a crew
of 30 men, only 15 of these being steel workers.

Girders were brought out on a temporary trestle,
on two flat cars with a derrick car on each end. They
were then lowered to rest on the second track portion
of the trestle and a temporary bent at the abutments.

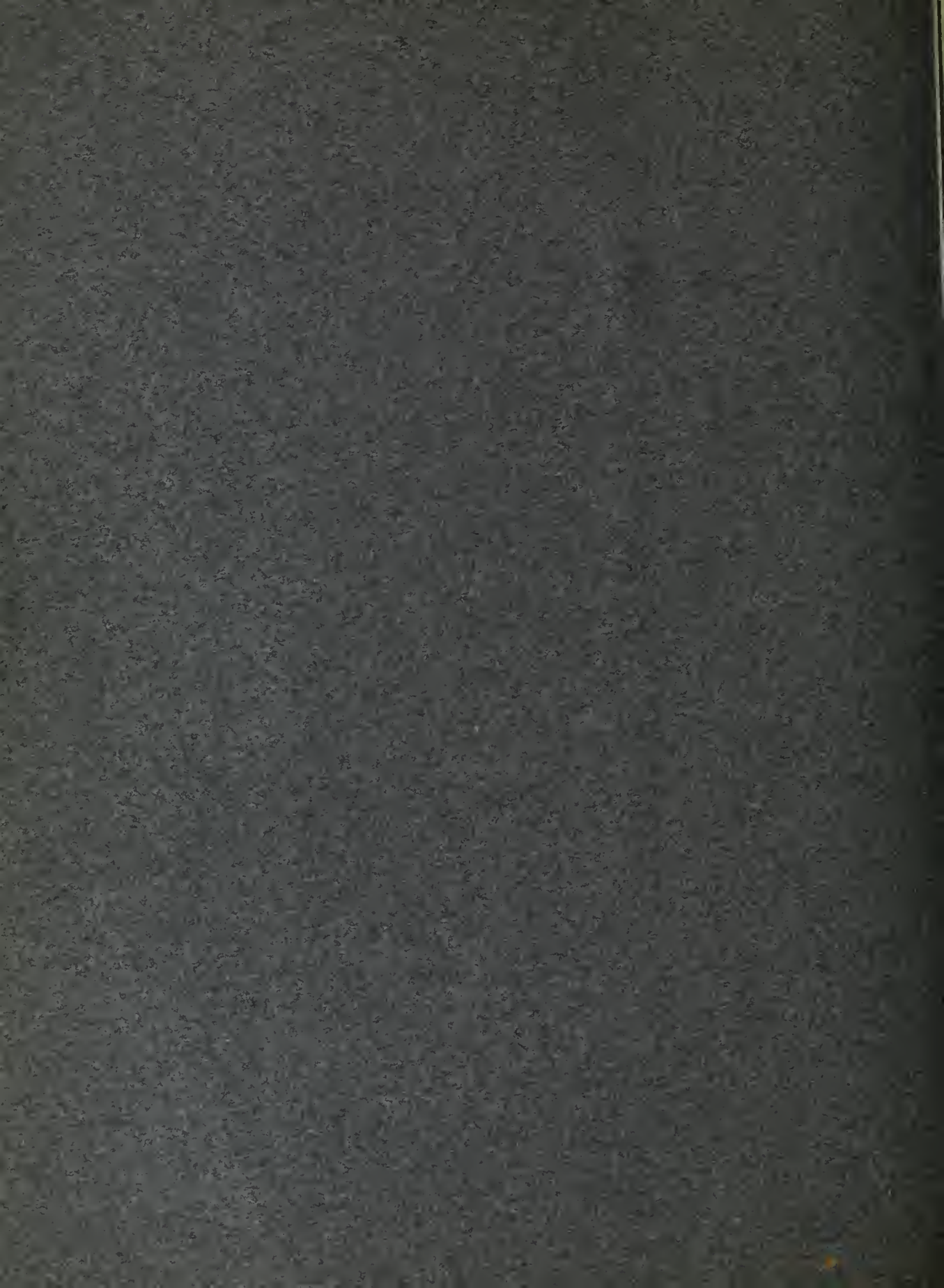
The ends of the temporary trestle were then pulled
and bent to the angle of the bridge. The ...











set on sheet lead over the places marked out on the concrete to receive them. The girders were then picked up with derrick at each end and swung into place. A temporary timber deck was then put on the concrete slabs for the steel not being made. This operation was repeated at each opening.

The piling of the temporary trestle was then pulled or broken by the derricks and the work was completed.

When all the steel was placed the riveting was done and the holes bored in the concrete for the anchor bolts. These bolts were slit and driven in on wedges, a neat cement being poured around them as a filler.

The slabs on the approaches were set in a like manner. The trestle was pulled out and the slabs which had been previously piled within reach of the derrick cars were picked up and put in place on a 1" bed of mortar. The deck was then replaced and the cracks between slabs filled with mortar. The ballast on the slab deck will be of crushed rock, being drained through holes provided in the slabs. This gives a solid, noiseless floor with little maintenance cost as compared to the old type of bridge decks.

The end.

The first step was to...
The second step was to...
The third step was to...
The fourth step was to...
The fifth step was to...
The sixth step was to...
The seventh step was to...
The eighth step was to...
The ninth step was to...
The tenth step was to...

The first step of the...
The second step of the...
The third step of the...
The fourth step of the...
The fifth step of the...
The sixth step of the...
The seventh step of the...
The eighth step of the...
The ninth step of the...
The tenth step of the...

The first step of the...
The second step of the...
The third step of the...
The fourth step of the...
The fifth step of the...
The sixth step of the...
The seventh step of the...
The eighth step of the...
The ninth step of the...
The tenth step of the...

The first step of the...
The second step of the...
The third step of the...
The fourth step of the...
The fifth step of the...
The sixth step of the...
The seventh step of the...
The eighth step of the...
The ninth step of the...
The tenth step of the...

... about 100 feet over the ground surface and on the
... to receive them. The distance was 100 feet
... to the deck and on the concrete side
... This operation was repeated

The filling of the temporary trench was then
... by the distance and the work was completed
... then all the steel was placed the riveting
... in the holes bored in the concrete for the anchor
... one half inch diameter and rivets in an angle
... rivets being ground down as a filler.

The sides on the ... were not in a
... and the ...
... of the ...
... on a 1" bed of mortar.
... and the ...
... The ballast on the side
... being ...
... This gives a ...
... to the ...



Appendix-Cost Data:- The cost of all the work was carefully recorded and separate distribution made of it for material and labor. This was tabulated upon the completion of the work and is shown on the blue print of the cost sheet. A full set of the working plans for the sub-structure are included, as printed from the tracing on file in the office of the Bridge & Building Department of the railway company.

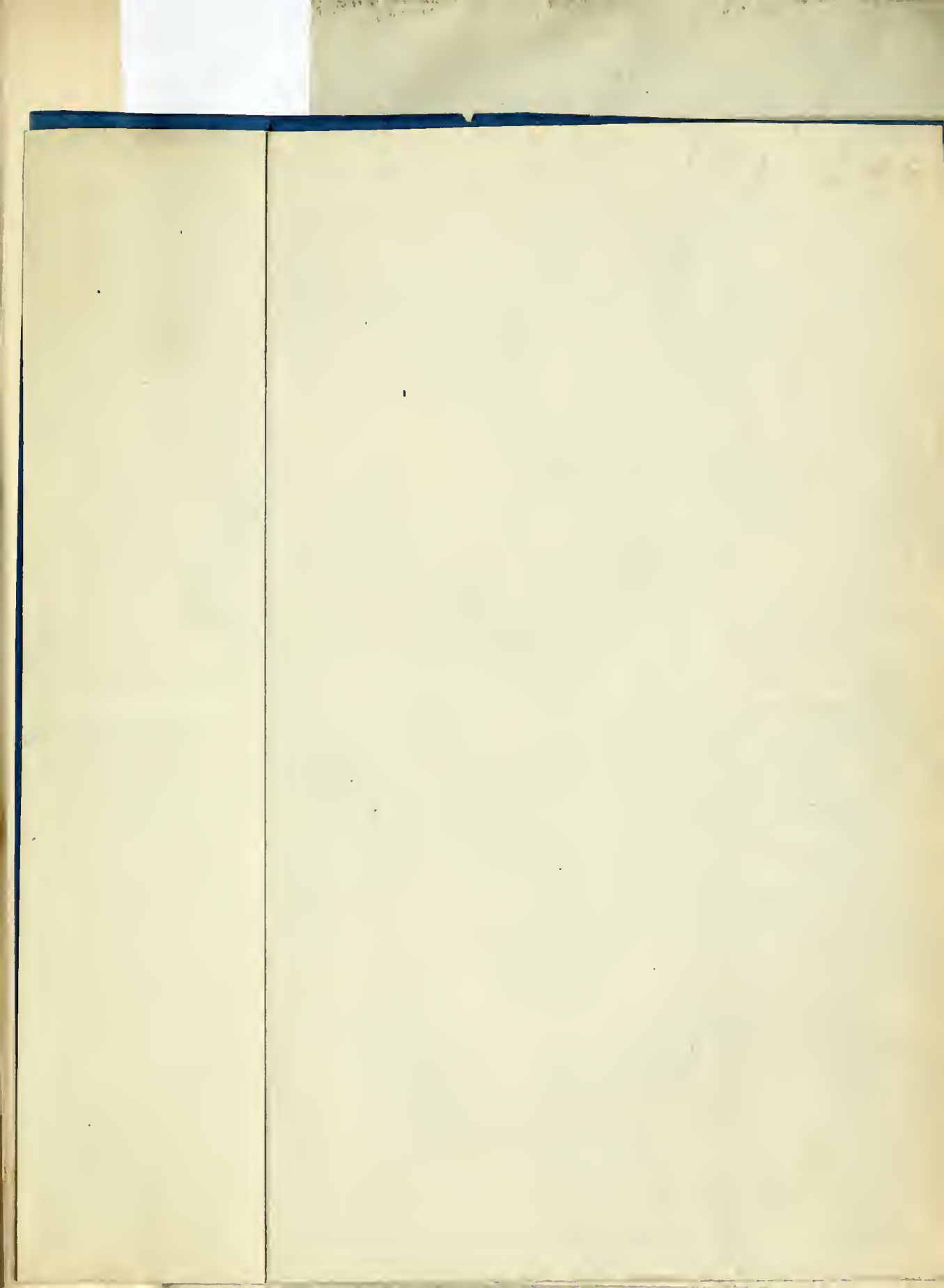
Respectfully submitted,

Clarence Verling Smith
117 - W 16th Ave.
Spokane
Wash.



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THE UNIVERSITY OF CHICAGO
DEPARTMENT OF CHEMISTRY
5800 SOUTH CAMPUS DRIVE
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Page 12 of 12

Idaho and Western Ry.
Coeur d'Alene Branch
A.G.Hall Div Engr
Spokane
Wash.

COST SHEET
OF
CONCRETE WORK
ON
SPOKANE RIVER BRIDGE
AT
SPOKANE BRIDGE
WASH.

Bates & Rogers Const'n Co
Contractors
Work Commenced August 23, 1910
Work Completed February 6, 1911
Compiled by C.U. Smith, Insp.
Spokane, Wash. Feb 20, 1911.

Remarks	Distribution:—	East Abut'mt.	Pier Number 1.	Pier Number 2.	Pier Number 3.	West Abut'mt.	General.	Totals.	Totals.	General Data:—	
Labor	Excavation.	\$37265			\$28160	\$23566		\$89091		Level and Locat.— Location: East Abutment, Pier No 2, West Abutment, Total	
	Filing.		\$69930	\$73086	31167			174193		Location: East Abutment, Pier No 2, West Abutment, Total	
	Caissons (Grillage.)		28802	34138				62940		Location: East Abutment, Pier No 2, West Abutment, Total	
	Cofferdam.				16989			16989		Location: East Abutment, Pier No 2, West Abutment, Total	
	Puddling.				7159			7159		Location: East Abutment, Pier No 2, West Abutment, Total	
	Forms.	61483	26149	29302	25209	119993			262136	Location: East Abutment, Pier No 2, West Abutment, Total	
	Reinforcing.	39960				101192			141152	Location: East Abutment, Pier No 2, West Abutment, Total	
	Concrete.	104838	55502	57060	36322	150903			404625	Location: East Abutment, Pier No 2, West Abutment, Total	
	Backfilling.	6682				3304			9986	Location: East Abutment, Pier No 2, West Abutment, Total	
	Gravel.	32601	22073	22390	22974	47915			147953	Location: East Abutment, Pier No 2, West Abutment, Total	
	Hauling Lumber.	4498	7408	7500	5506	8350	\$1082		34344	Location: East Abutment, Pier No 2, West Abutment, Total	
	Hauling Cement.	6267	4147	4666	4140	9580			28782	Location: East Abutment, Pier No 2, West Abutment, Total	
	Rip Rap.	14010	60843	86902	33934	1631			196880	Location: East Abutment, Pier No 2, West Abutment, Total	
	Roadway.	17361				16275			33636	Location: East Abutment, Pier No 2, West Abutment, Total	
	Material	Outfit.						60792	60792		Location: East Abutment, Pier No 2, West Abutment, Total
Fencing.							973	973		Location: East Abutment, Pier No 2, West Abutment, Total	
Loading Piling.							2793	2793		Location: East Abutment, Pier No 2, West Abutment, Total	
Temporary Work Trestle.							27903	27903		Location: East Abutment, Pier No 2, West Abutment, Total	
Repairing falsework.							35271	35271		Location: East Abutment, Pier No 2, West Abutment, Total	
Clearing River (Log Jam)							44520	44520		Location: East Abutment, Pier No 2, West Abutment, Total	
Clearing Up							51566	51566		Location: East Abutment, Pier No 2, West Abutment, Total	
General Roll (Suprtance, etc)							9045	9045		Location: East Abutment, Pier No 2, West Abutment, Total	
Liability Insurance.							53405	53405		Location: East Abutment, Pier No 2, West Abutment, Total	
Totals.		324965	274354	315021	211620	482788	287350	1896099		Location: East Abutment, Pier No 2, West Abutment, Total	
Percentage. (12 1/2%)		40620	34294	39378	26452	60349	35919	237012		Location: East Abutment, Pier No 2, West Abutment, Total	
Totals.		\$365585	\$308648	\$354399	\$238072	\$543138	\$323269	\$2133111		Location: East Abutment, Pier No 2, West Abutment, Total	
Percentage		Sand.	\$19530	\$13251	\$13392	\$13857	\$28830		\$88660		Location: East Abutment, Pier No 2, West Abutment, Total
		Cement.	142505	94600	106480	94050	216975		654610		Location: East Abutment, Pier No 2, West Abutment, Total
		Piling.		26136	26664	16145		\$14355	83300		Location: East Abutment, Pier No 2, West Abutment, Total
	Reinforcing Bars. 1 inch	18764				62821		81585		Location: East Abutment, Pier No 2, West Abutment, Total	
	" " 3/4	20888				31336		52224		Location: East Abutment, Pier No 2, West Abutment, Total	
	" " 1/2	10211				23831		34042		Location: East Abutment, Pier No 2, West Abutment, Total	
	Lumber.	1742				3484	26571	31797		Location: East Abutment, Pier No 2, West Abutment, Total	
	Forms.	31176	11258	11506	12124	57651		123715		Location: East Abutment, Pier No 2, West Abutment, Total	
	Cofferdam.				28420			28420		Location: East Abutment, Pier No 2, West Abutment, Total	
	Caissons (Grillage.)		42583	42583				85166		Location: East Abutment, Pier No 2, West Abutment, Total	
	Miscellaneous.	6964	14411	14107	3930	11463	60512	111387		Location: East Abutment, Pier No 2, West Abutment, Total	
	(Office, etc.)						11450	11450		Location: East Abutment, Pier No 2, West Abutment, Total	
	Totals.	251780	202299	214732	168526	436391	112898	1386556		Location: East Abutment, Pier No 2, West Abutment, Total	
	Percentage. (18 1/2%)	31473	25297	26842	21057	54549	14111	173319		Location: East Abutment, Pier No 2, West Abutment, Total	
	Totals.	\$283253	\$227326	\$241574	\$189583	\$490940	\$126939	\$1559875		Location: East Abutment, Pier No 2, West Abutment, Total	
Freight.	16339	13250	14600	10687	24951	117221	197048		Location: East Abutment, Pier No 2, West Abutment, Total		
Miscellaneous.						7192	7192		Location: East Abutment, Pier No 2, West Abutment, Total		
Engineering (Salaries, etc)						123336	123336		Location: East Abutment, Pier No 2, West Abutment, Total		
Totals	\$16339	\$13250	\$14600	\$10687	\$24951	\$247749	\$327576		Location: East Abutment, Pier No 2, West Abutment, Total		
Grand Totals.	\$665177	\$549424	\$610573	\$438342	\$1059029	\$639017	\$4020562		Location: East Abutment, Pier No 2, West Abutment, Total		

Level and Locat.—
Location: East Abutment, Pier No 2, West Abutment, Total

Excavation.
Location: East Abutment, Pier No 2, West Abutment, Total

Filing.
Location: East Abutment, Pier No 2, West Abutment, Total

Concrete.
Location: East Abutment, Pier No 2, West Abutment, Total

Gravel.
Location: East Abutment, Pier No 2, West Abutment, Total

Rip Rap.
Location: East Abutment, Pier No 2, West Abutment, Total

Reinforcing Bars.
Location: East Abutment, Pier No 2, West Abutment, Total

Miscellaneous.
Location: East Abutment, Pier No 2, West Abutment, Total

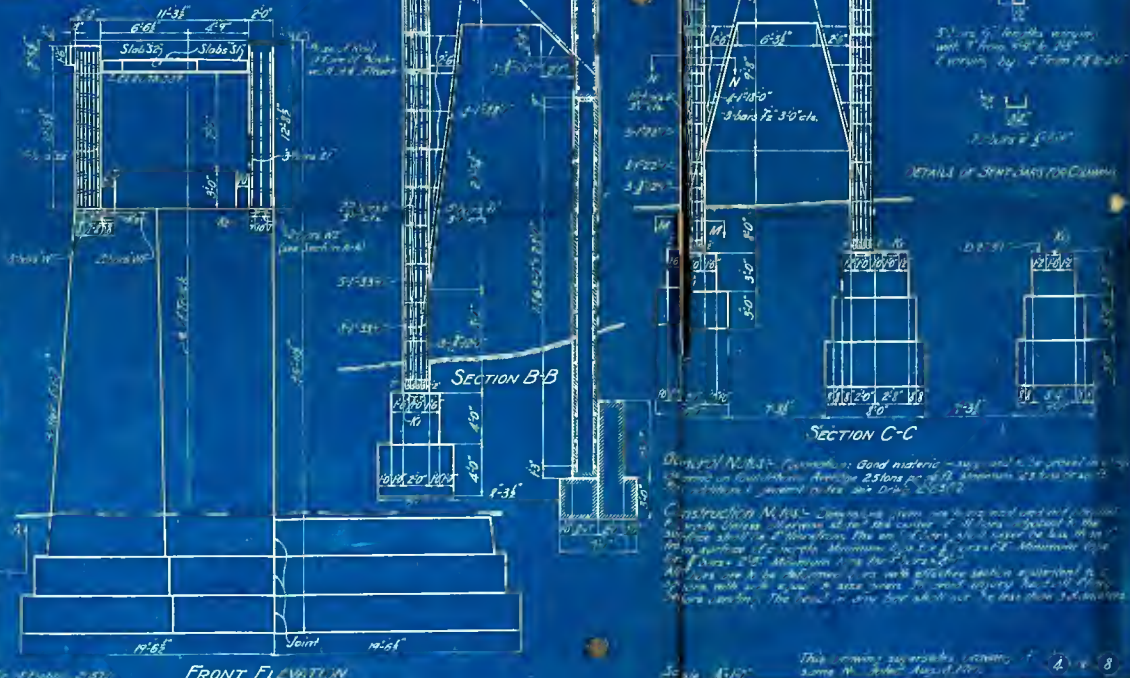
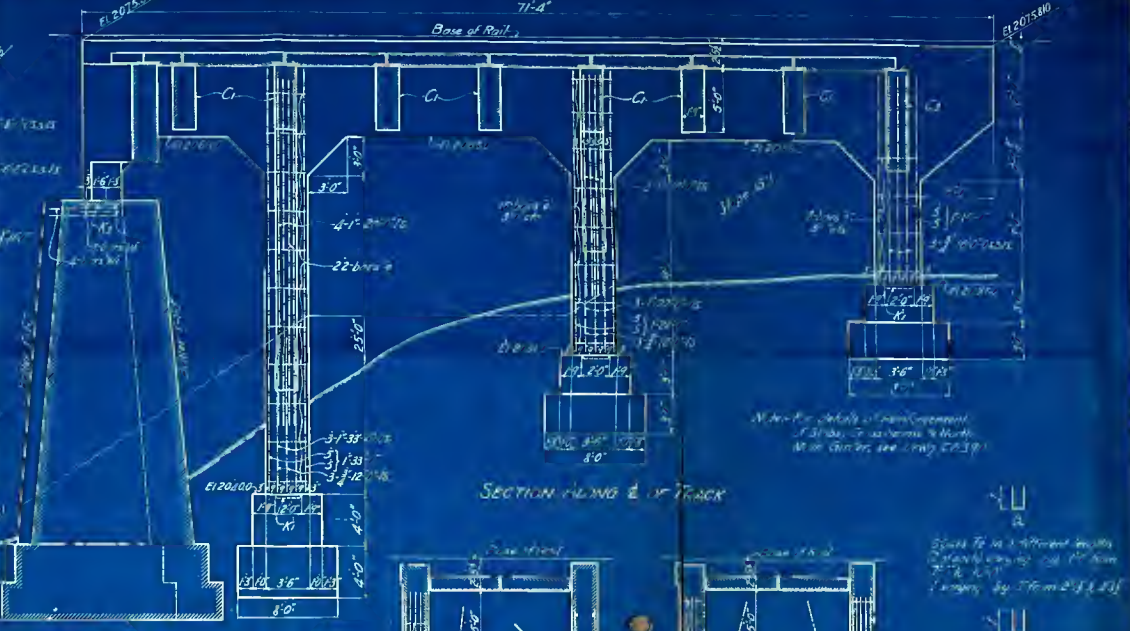
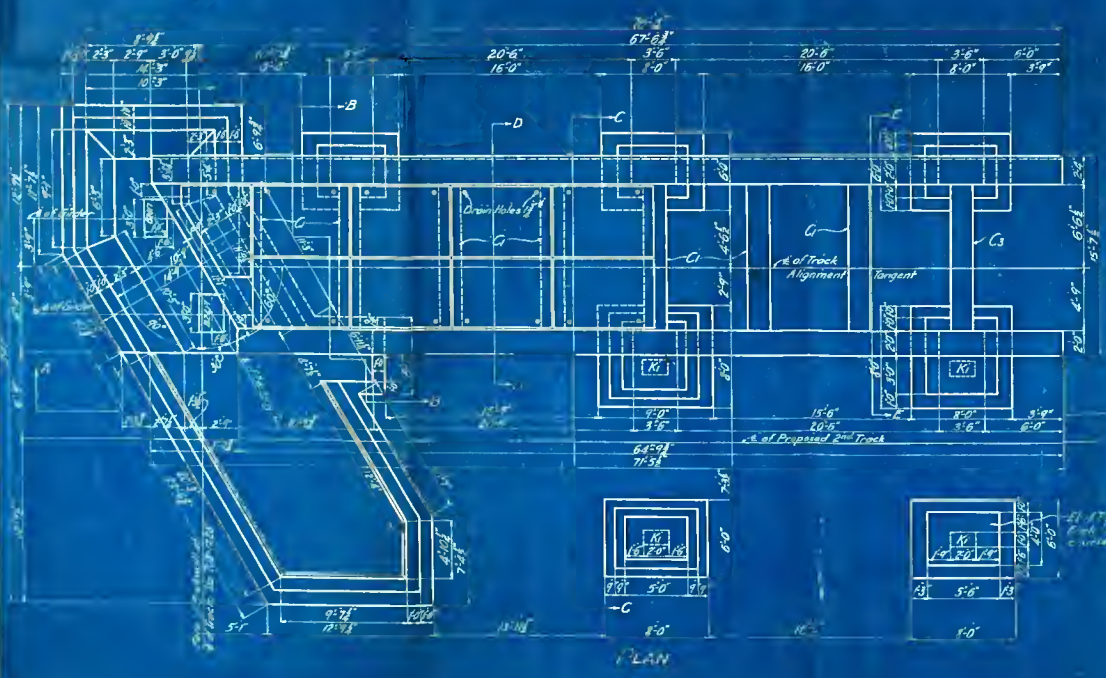
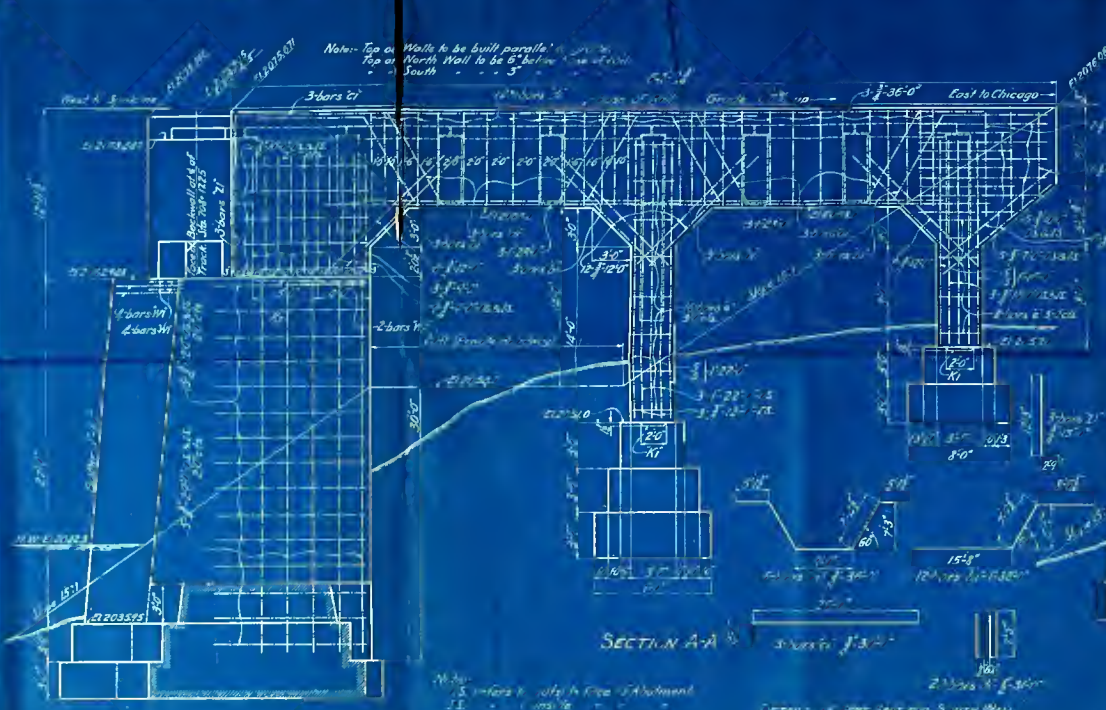
Percentage.
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Freight.
Location: East Abutment, Pier No 2, West Abutment, Total

Miscellaneous.
Location: East Abutment, Pier No 2, West Abutment, Total

Engineering (Salaries, etc)
Location: East Abutment, Pier No 2, West Abutment, Total

Grand Totals.
Location: East Abutment, Pier No 2, West Abutment, Total



FRONT ELEVATION

Construction Notes (Road)

This drawing represents a section of the bridge structure. It is intended to be used in conjunction with the other drawings in this set. The contractor is to be responsible for the proper interpretation and execution of the design. The bridge structure is to be built in accordance with the specifications and standards of the U.S. Department of Transportation. The bridge structure is to be built in accordance with the specifications and standards of the U.S. Department of Transportation. The bridge structure is to be built in accordance with the specifications and standards of the U.S. Department of Transportation.

Approved: *A. Loweth*
ENGR & SUPT. B.&B.

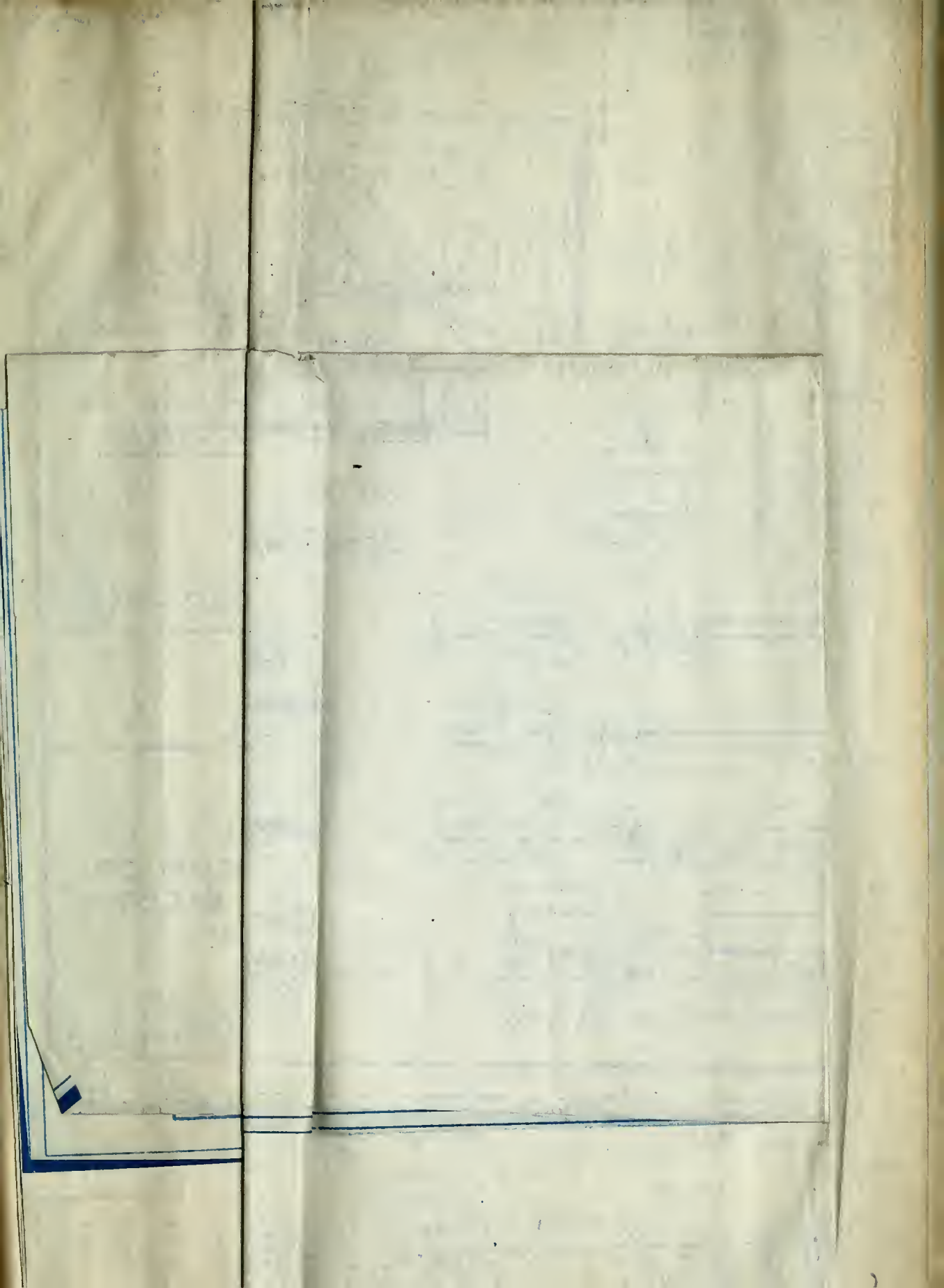
Checked: *J.H. Platt*
1952, Encl.

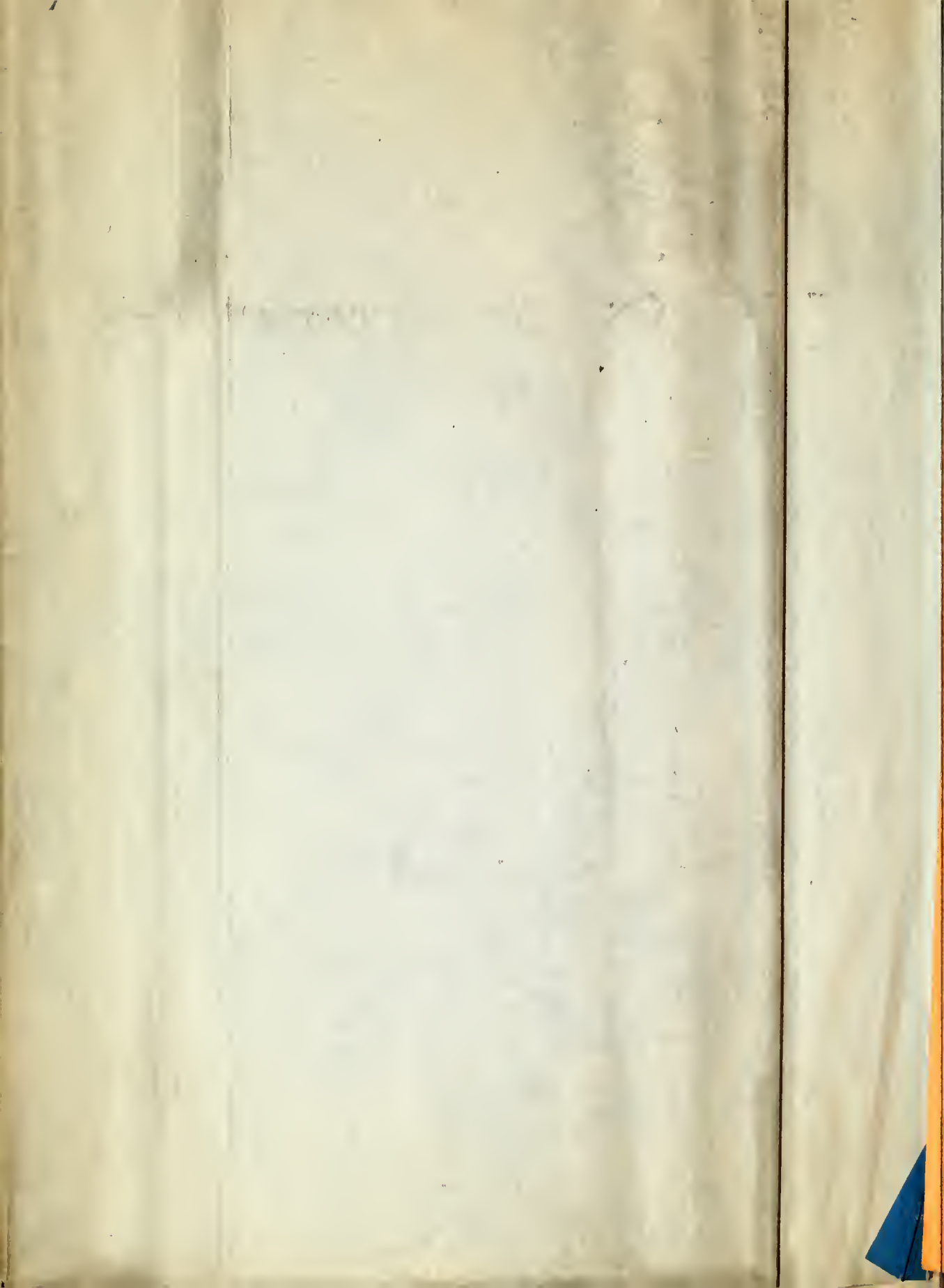
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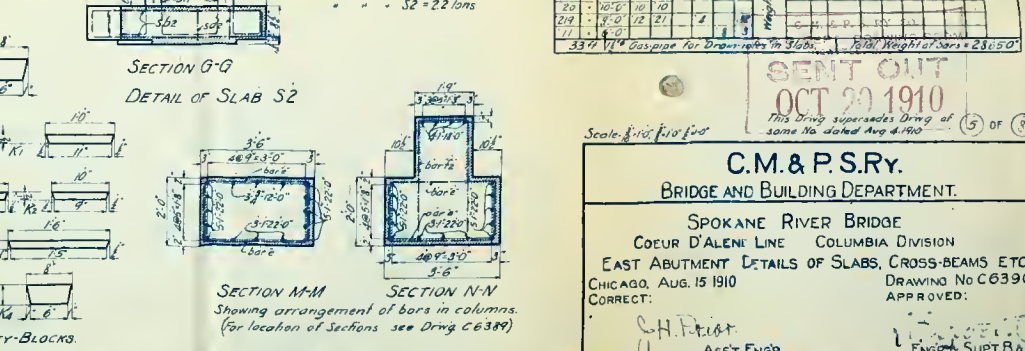
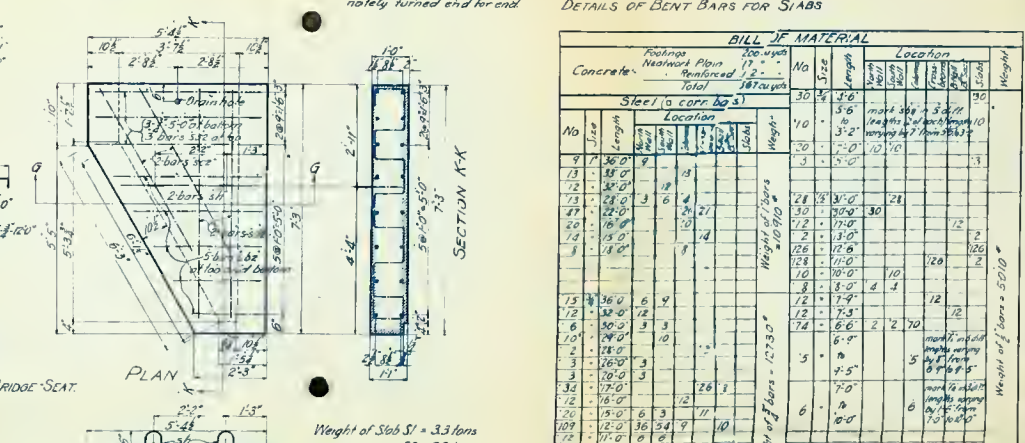
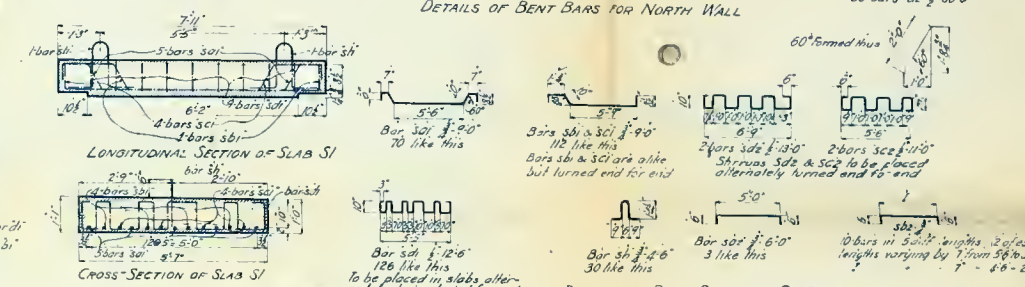
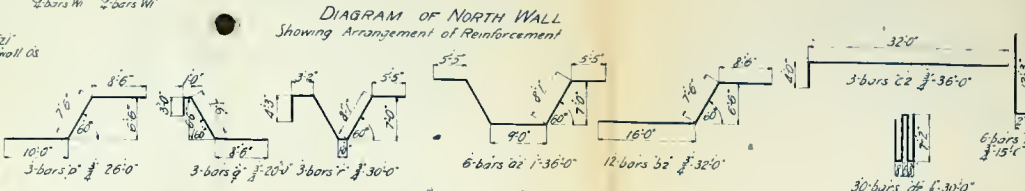
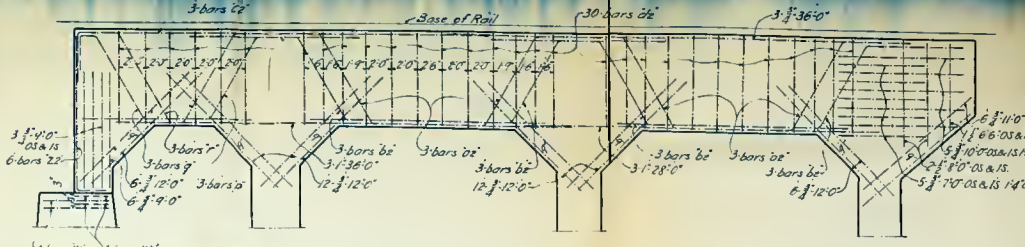
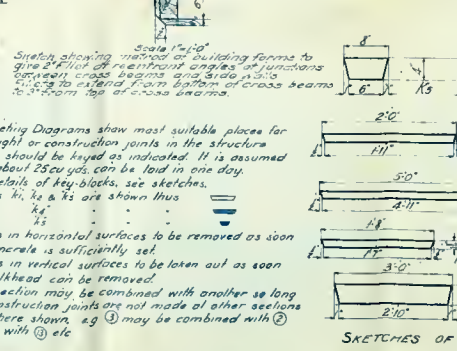
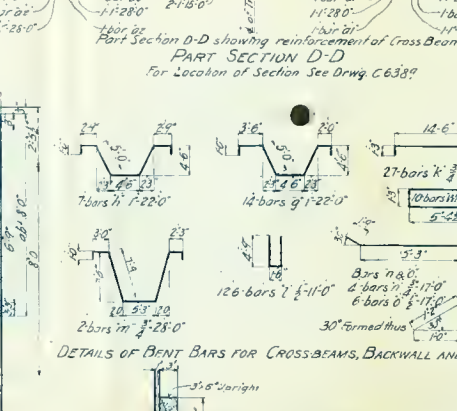
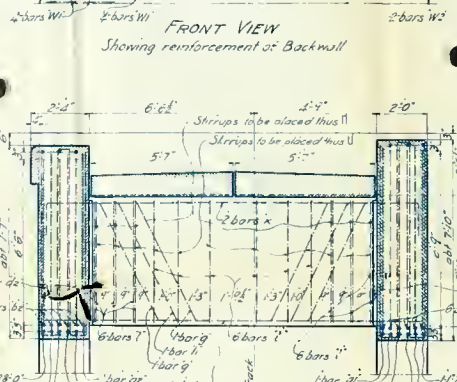
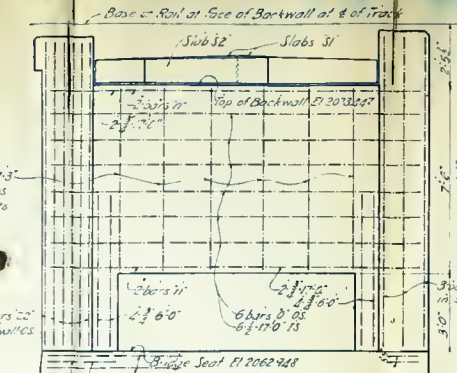
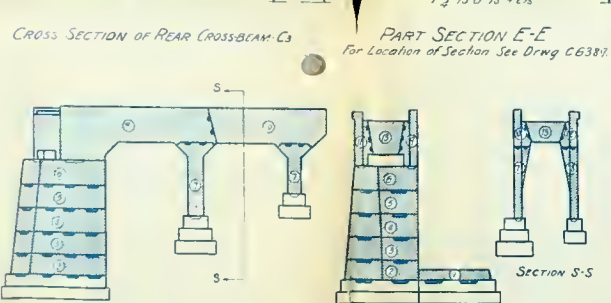
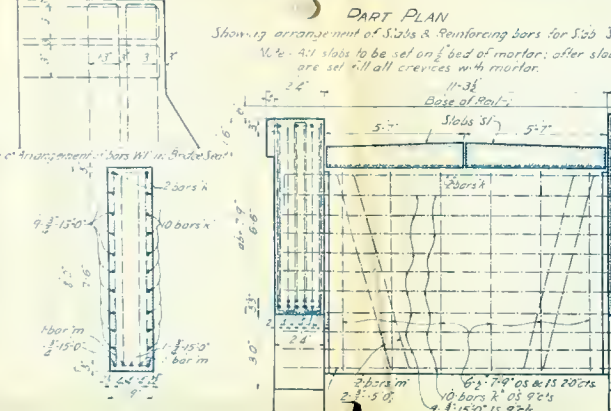
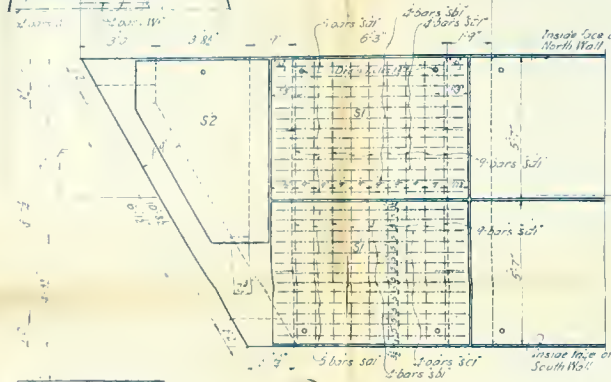
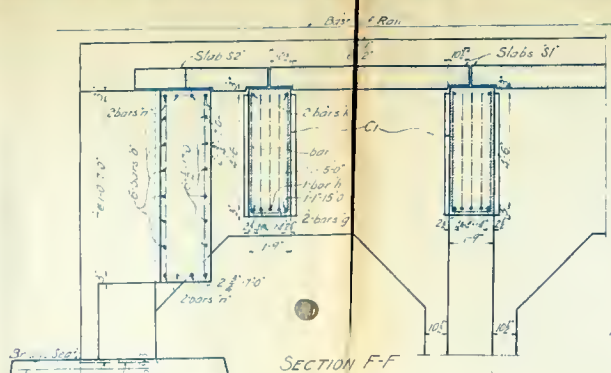
DRAWING NO C6389

EAST ALIGNMENT - PLAN & ELEVATIONS

SPokane River Bridge
CHEW VALENE LINE - COLUMBIA DIVISION
BRIDGE AND BUILDING DEPARTMENT.
C.M.&P.S.R.Y.







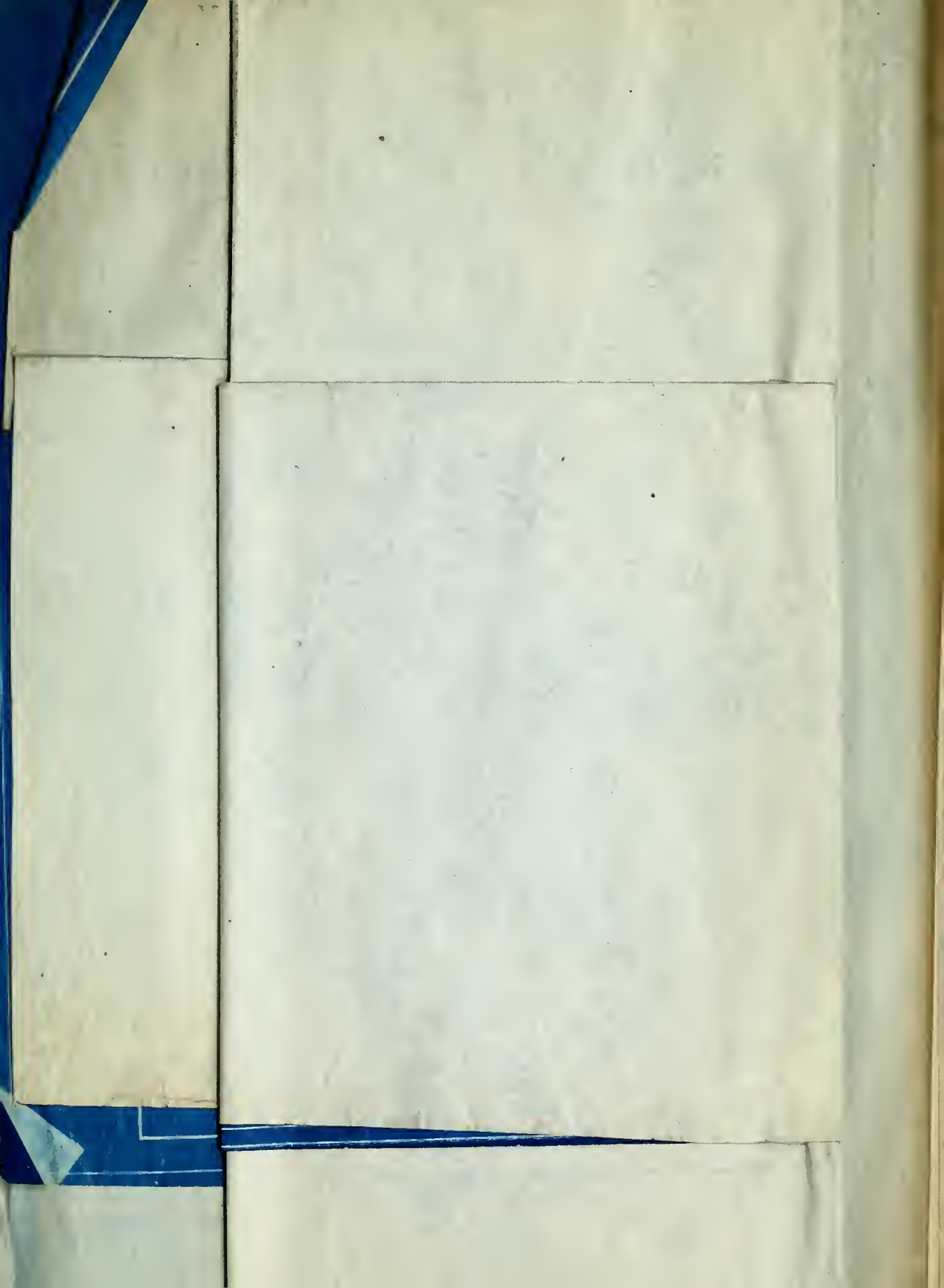
BILL OF MATERIAL

Concrete		Reinforcing Bars		Steel (corr. bars)		Location		Weight	
No.	Length	No.	Weight	No.	Weight	No.	Weight	No.	Weight
1	36.0'	9	18.0'	1	1.0'	1	1.0'	1	1.0'
2	18.0'	18	36.0'	2	2.0'	2	2.0'	2	2.0'
3	18.0'	18	36.0'	3	3.0'	3	3.0'	3	3.0'
4	18.0'	18	36.0'	4	4.0'	4	4.0'	4	4.0'
5	18.0'	18	36.0'	5	5.0'	5	5.0'	5	5.0'
6	18.0'	18	36.0'	6	6.0'	6	6.0'	6	6.0'
7	18.0'	18	36.0'	7	7.0'	7	7.0'	7	7.0'
8	18.0'	18	36.0'	8	8.0'	8	8.0'	8	8.0'
9	18.0'	18	36.0'	9	9.0'	9	9.0'	9	9.0'
10	18.0'	18	36.0'	10	10.0'	10	10.0'	10	10.0'
11	18.0'	18	36.0'	11	11.0'	11	11.0'	11	11.0'
12	18.0'	18	36.0'	12	12.0'	12	12.0'	12	12.0'
13	18.0'	18	36.0'	13	13.0'	13	13.0'	13	13.0'
14	18.0'	18	36.0'	14	14.0'	14	14.0'	14	14.0'
15	18.0'	18	36.0'	15	15.0'	15	15.0'	15	15.0'
16	18.0'	18	36.0'	16	16.0'	16	16.0'	16	16.0'
17	18.0'	18	36.0'	17	17.0'	17	17.0'	17	17.0'
18	18.0'	18	36.0'	18	18.0'	18	18.0'	18	18.0'
19	18.0'	18	36.0'	19	19.0'	19	19.0'	19	19.0'
20	18.0'	18	36.0'	20	20.0'	20	20.0'	20	20.0'
21	18.0'	18	36.0'	21	21.0'	21	21.0'	21	21.0'
22	18.0'	18	36.0'	22	22.0'	22	22.0'	22	22.0'
23	18.0'	18	36.0'	23	23.0'	23	23.0'	23	23.0'
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25	18.0'	18	36.0'	25	25.0'	25	25.0'	25	25.0'
26	18.0'	18	36.0'	26	26.0'	26	26.0'	26	26.0'
27	18.0'	18	36.0'	27	27.0'	27	27.0'	27	27.0'
28	18.0'	18	36.0'	28	28.0'	28	28.0'	28	28.0'
29	18.0'	18	36.0'	29	29.0'	29	29.0'	29	29.0'
30	18.0'	18	36.0'	30	30.0'	30	30.0'	30	30.0'
31	18.0'	18	36.0'	31	31.0'	31	31.0'	31	31.0'
32	18.0'	18	36.0'	32	32.0'	32	32.0'	32	32.0'
33	18.0'	18	36.0'	33	33.0'	33	33.0'	33	33.0'
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36	18.0'	18	36.0'	36	36.0'	36	36.0'	36	36.0'
37	18.0'	18	36.0'	37	37.0'	37	37.0'	37	37.0'
38	18.0'	18	36.0'	38	38.0'	38	38.0'	38	38.0'
39	18.0'	18	36.0'	39	39.0'	39	39.0'	39	39.0'
40	18.0'	18	36.0'	40	40.0'	40	40.0'	40	40.0'
41	18.0'	18	36.0'	41	41.0'	41	41.0'	41	41.0'
42	18.0'	18	36.0'	42	42.0'	42	42.0'	42	42.0'
43	18.0'	18	36.0'	43	43.0'	43	43.0'	43	43.0'
44	18.0'	18	36.0'	44	44.0'	44	44.0'	44	44.0'
45	18.0'	18	36.0'	45	45.0'	45	45.0'	45	45.0'
46	18.0'	18	36.0'	46	46.0'	46	46.0'	46	46.0'
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49	18.0'	18	36.0'	49	49.0'	49	49.0'	49	49.0'
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53	18.0'	18	36.0'	53	53.0'	53	53.0'	53	53.0'
54	18.0'	18	36.0'	54	54.0'	54	54.0'	54	54.0'
55	18.0'	18	36.0'	55	55.0'	55	55.0'	55	55.0'
56	18.0'	18	36.0'	56	56.0'	56	56.0'	56	56.0'
57	18.0'	18	36.0'	57	57.0'	57	57.0'	57	57.0'
58	18.0'	18	36.0'	58	58.0'	58	58.0'	58	58.0'
59	18.0'	18	36.0'	59	59.0'	59	59.0'	59	59.0'
60	18.0'	18	36.0'	60	60.0'	60	60.0'	60	60.0'
61	18.0'	18	36.0'	61	61.0'	61	61.0'	61	61.0'
62	18.0'	18	36.0'	62	62.0'	62	62.0'	62	62.0'
63	18.0'	18	36.0'	63	63.0'	63	63.0'	63	63.0'
64	18.0'	18	36.0'	64	64.0'	64	64.0'	64	64.0'
65	18.0'	18	36.0'	65	65.0'	65	65.0'	65	65.0'
66	18.0'	18	36.0'	66	66.0'	66	66.0'	66	66.0'
67	18.0'	18	36.0'	67	67.0'	67	67.0'	67	67.0'
68	18.0'	18	36.0'	68	68.0'	68	68.0'	68	68.0'
69	18.0'	18	36.0'	69	69.0'	69	69.0'	69	69.0'
70	18.0'	18	36.0'	70	70.0'	70	70.0'	70	70.0'
71	18.0'	18	36.0'	71	71.0'	71	71.0'	71	71.0'
72	18.0'	18	36.0'	72	72.0'	72	72.0'	72	72.0'
73	18.0'	18	36.0'	73	73.0'	73	73.0'	73	73.0'
74	18.0'	18	36.0'	74	74.0'	74	74.0'	74	74.0'
75	18.0'	18	36.0'	75	75.0'	75	75.0'	75	75.0'
76	18.0'	18	36.0'	76	76.0'	76	76.0'	76	76.0'
77	18.0'	18	36.0'	77	77.0'	77	77.0'	77	77.0'
78	18.0'	18	36.0'	78	78.0'	78	78.0'	78	78.0'
79	18.0'	18	36.0'	79	79.0'	79	79.0'	79	79.0'
80	18.0'	18	36.0'	80	80.0'	80	80.0'	80	80.0'
81	18.0'	18	36.0'	81	81.0'	81	81.0'	81	81.0'
82	18.0'	18	36.0'	82	82.0'	82	82.0'	82	82.0'
83	18.0'	18	36.0'	83	83.0'	83	83.0'	83	83.0'
84	18.0'	18	36.0'	84	84.0'	84	84.0'	84	84.0'
85	18.0'	18	36.0'	85	85.0'	85	85.0'	85	85.0'
86	18.0'	18	36.0'	86	86.0'	86	86.0'	86	86.0'
87	18.0'	18	36.0'	87	87.0'	87	87.0'	87	87.0'
88	18.0'	18	36.0'	88	88.0'	88	88.0'	88	88.0'
89	18.0'	18	36.0'	89	89.0'	89	89.0'	89	89.0'
90	18.0'	18	36.0'	90	90.0'	90	90.0'	90	90.0'
91	18.0'	18	36.0'	91	91.0'	91	91.0'	91	91.0'
92	18.0'	18	36.0'	92	92.0'	92	92.0'	92	92.0'
93	18.0'	18	36.0'	93	93.0'	93	93.0'	93	93.0'
94	18.0'	18	36.0'	94	94.0'	94	94.0'	94	94.0'
95	18.0'	18	36.0'	95	95.0'	95	95.0'	95	95.0'
96	18.0'	18	36.0'	96	96.0'	96	96.0'	96	96.0'
97	18.0'	18	36.0'	97	97.0'	97	97.0'	97	97.0'
98	18.0'	18	36.0'	98	98.0'	98	98.0'	98	98.0'
99	18.0'	18	36.0'	99	99.0'	99	99.0'	99	99.0'
100	18.0'	18	36.0'	100	100.0'	100	100.0'	100	100.0'

SENT OUT OCT 29 1910
This drawing supersedes drawing of same No. dated Aug 4, 1910.

Scale: 1/4" = 1'-0"
C.M. & P.S.R.Y.
BRIDGE AND BUILDING DEPARTMENT.
SPOKANE RIVER BRIDGE
COEUR D'ALENE LINE COLUMBIA DIVISION
EAST ABUTMENT DETAILS OF SLABS, CROSS-BEAMS ETC.
CHICAGO, AUG. 15 1910 DRAWING NO. C6399
CORRECT: APPROVED:
G.H.P. ASST. ENGR.
ENGR. Supt. B.B.



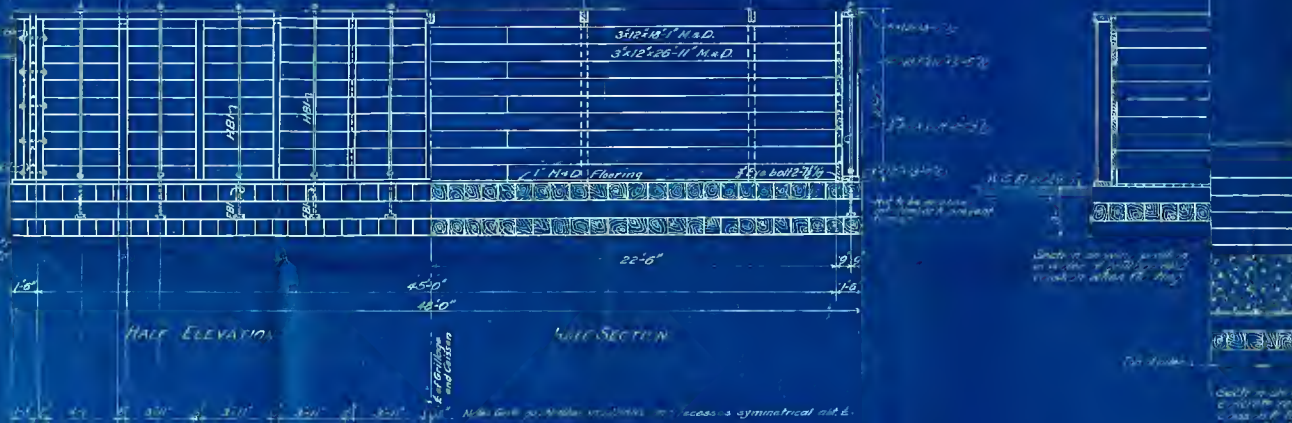






BILL OF MATERIAL FOR 2 CAISSONS (PIERS Nos. 1&2)

No.	DESCRIPTION	REMARKS
58	Piles 6" x 10" x 2'-6"	Rough
9	" 3" x 10" x 2'-3"	" "
6	3" x 12" x 2'-6"	" "
7	3" x 12" x 1'-6"	" "
8	3" x 12" x 2'-6"	SIS & IE
11	3" x 12" x 1'-6"	SIS & IE
12	3" x 12" x 1'-6"	M & D
13	3" x 12" x 2'-6"	M & D
14	3" x 12" x 1'-6"	M & D
15	3" x 12" x 2'-6"	M & D
16	3" x 12" x 1'-6"	Rough
17	3" x 12" x 1'-6"	HBI
18	3" x 12" x 1'-6"	PBI
128	14" Minimum Floor Joist No. 22, 2" x 12" x 1'-6"	
2200	2 in. FT. 12 1/2" Planking and 1/2" Studs	M & D



BILL OF MATERIAL IN GRILLAGE UNDER PIERS Nos. 1&2

No.	DESCRIPTION	REMARKS
88	12" x 12" x 16'-0"	SIS 16 1/2"
196	12" x 12" x 16'-0"	" "
290	12" x 12" x 16'-0"	Bottom Course
1400	12" x 12" x 16'-0"	Upper Courses
18	Eye Bolts	EBI



END ELEVATION



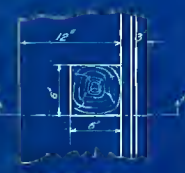
SKETCH of pile caps for No. 1 & 2 Piers

PLAN showing the various course of Grillage.



SECTION A-A

DETAIL AT 5 FT. M. FLOOR



SECTION B-B



Eye Bolt EBI



Detail of Bolt

General Note: The caissons are to be constructed of concrete and reinforced with steel. The reinforcement is to be placed in accordance with the specifications for concrete and steel. The caissons are to be constructed in two courses, the bottom course and the upper course. The bottom course is to be constructed of concrete and reinforced with steel. The upper course is to be constructed of concrete and reinforced with steel. The caissons are to be constructed in accordance with the specifications for concrete and steel.

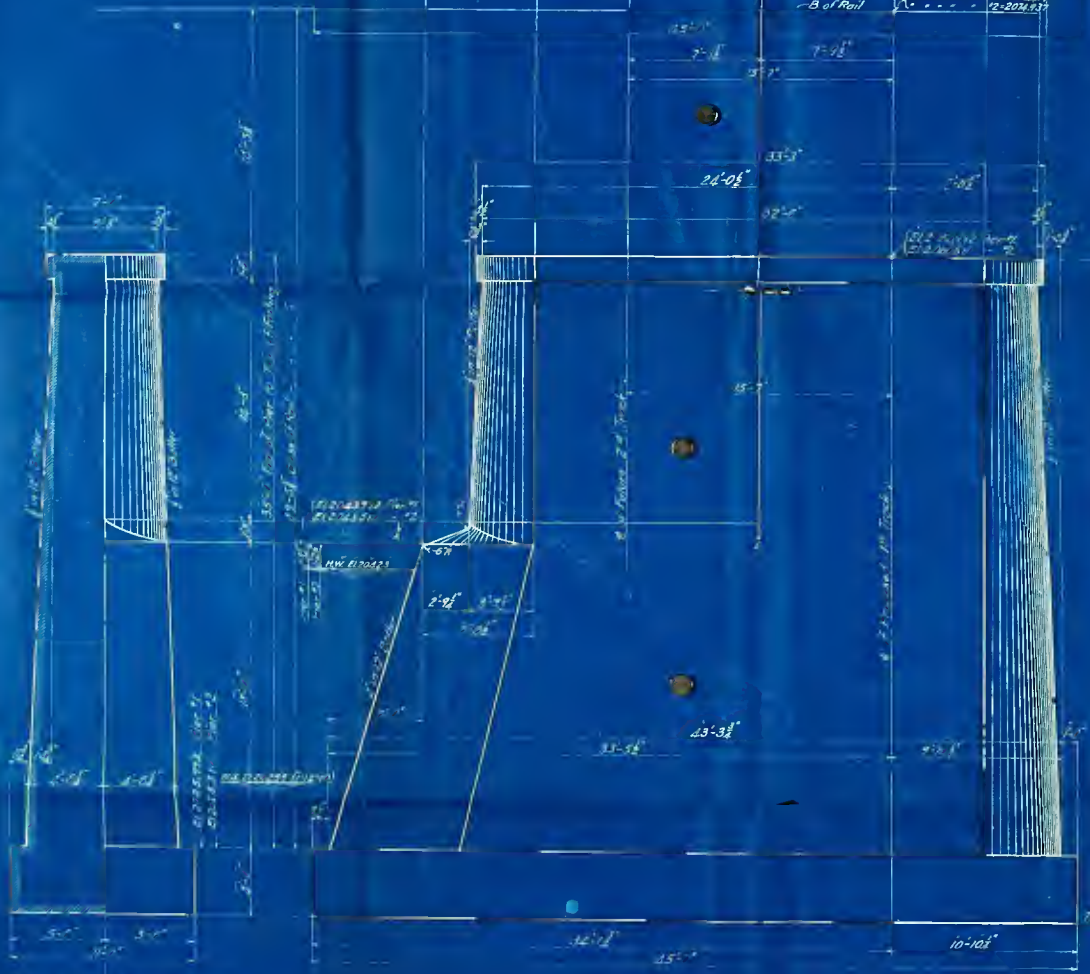
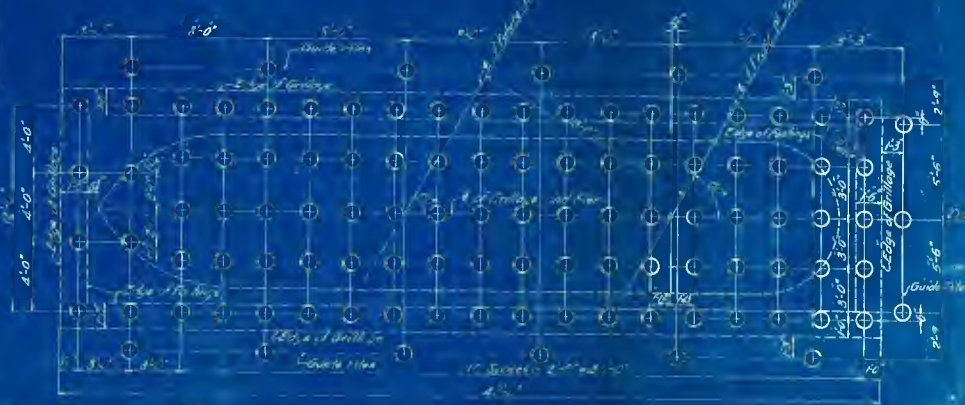
C.M. & P.S.R.Y.
 ENGINE AND BUILDING DEPARTMENT.
 SPOKANE RIVER BRIDGE
 CLATSOP COUNTY, OREGON
 CAISSONS FOR PIERS Nos. 1 & 2

DESIGNED BY J.H. HART
 CHECKED BY J.H. HART
 DRAWING NO. C-137
 APPROVED BY J.H. HART
 J.H. HART
 Chief Eng.

CHAS. J. KROETH
 Chief Eng.







Elevation of Pier and Footings for Piers Nos. 1462 & 1463
 Given as per plan for each Elevation shall
 will. Also there to be used in subsequent markings
 of them.
 If additional cables were required to assist in
 working piers, they may be drawn at a later
 time and have to be located by Engineer in field.

Notes:
 Call out of concrete in Marking Piers Nos. 1462 & 1463
 = Footings = 1462 & 1463
 = 1462 & 1463
 No. of Piles required under Piers Nos. 1462 & 1463
 = 1462 & 1463
 Average Depth of Piers to be drilled = 178 ft.
 For drilling a drill rig is to be used for Piers Nos. 1462 & 1463.
 For marking details in this regard, General notes are to be used.

C.M. & P.S.Ry.
 BRIDGE AND BUILDING DEPARTMENT.
 SPOKANE RIVER BRIDGE
 GREAT D'ALENE LINE, OLYMPIA DIVISION.
 DETAILS OF PIERS NOS. 1462

CHICAGO, ILL. JUNE 1910
 CORRECTED

DRAWING NO. C.F. 30
 APPROVED
E. J. Howard
 ENGR. S. U. T. B. A.

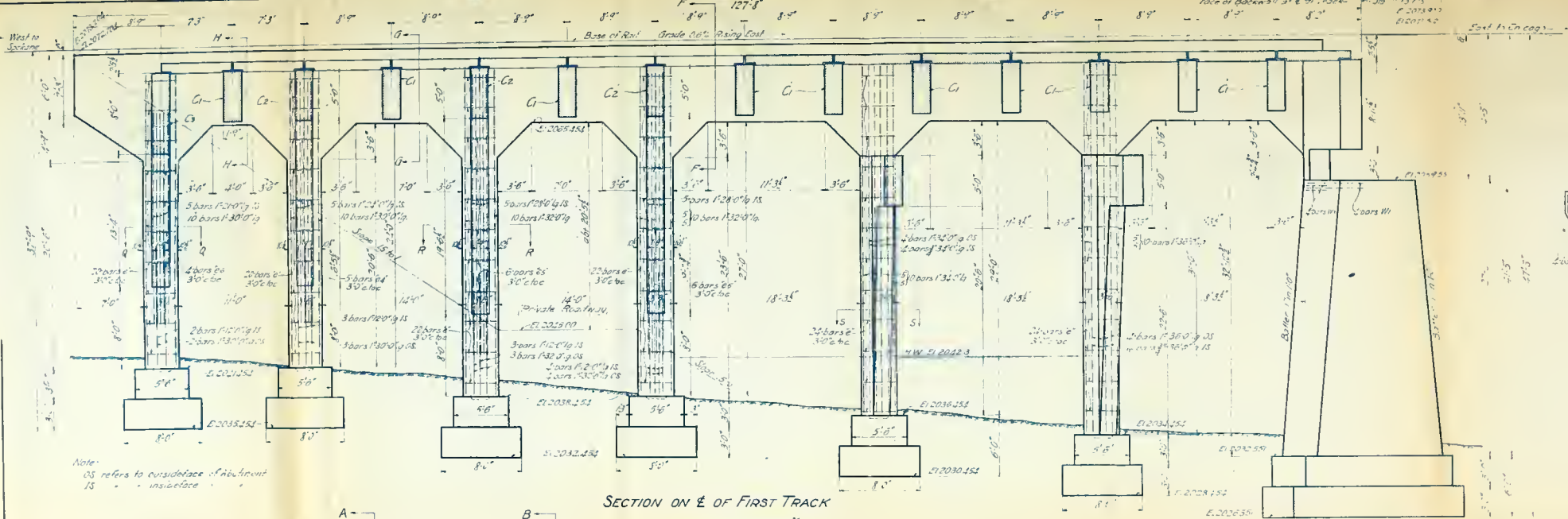


27

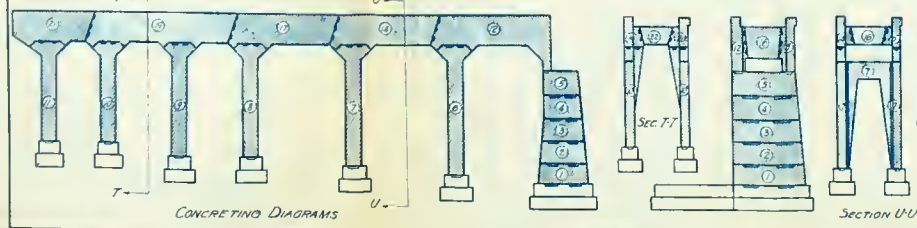
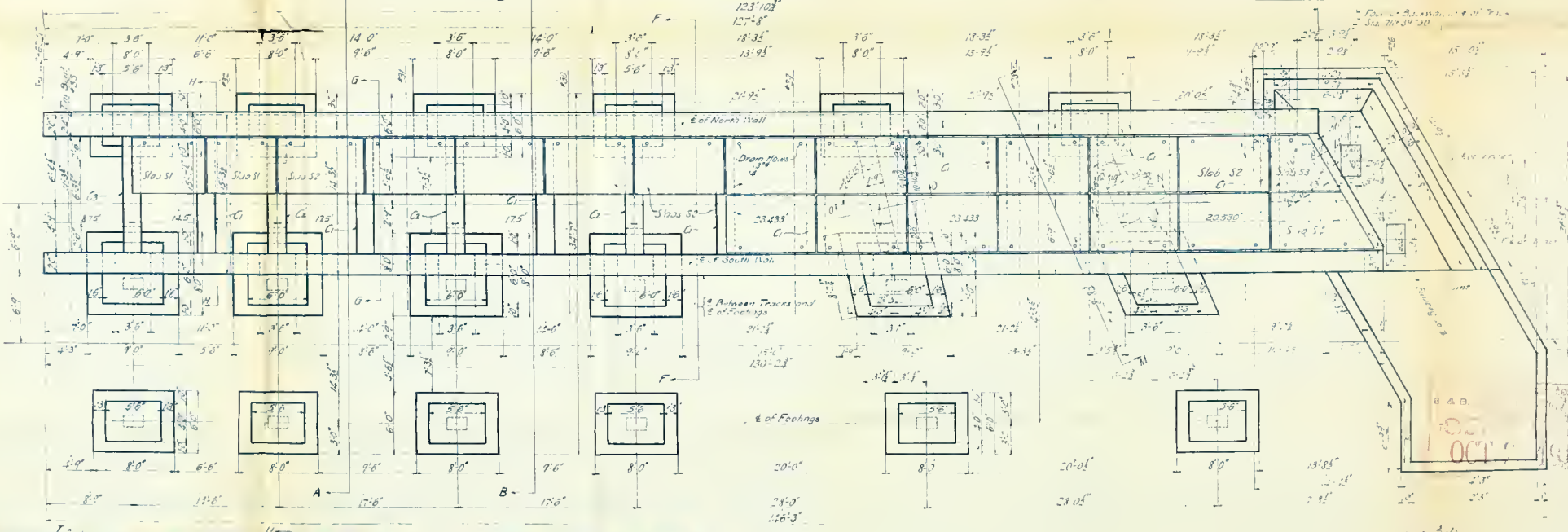


[Faint, illegible text, possibly bleed-through from the reverse side of the page.]



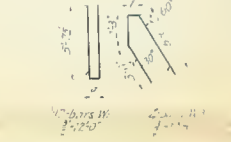
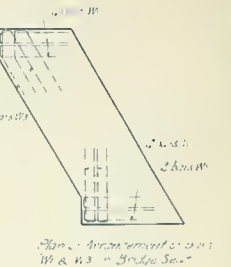


SECTION ON E OF FIRST TRACK



PLAN
 Notes about Concreting Diagrams for East Abutment on Draw C6390 apply to West Abutment unless superseded by the following notes. For detail of key block K6 see station 81+00, for details of key blocks K1, K2 and K3 see Draw C6390. Blocks K1 and K6 are shown, thus sections which may be combined are (A) or (V) with (6), (2) with (5) etc.

General Notes: Foundation of Joints - supposed to be in all bearings in the structure. Bridge 20 tons on 5 ft. diameter IS 18 pipes. For additional details see Draw C6389. If Engineer is changing details or necessary roadway is to be protected against scour by dunnage or dunnage for construction hole, see Draw C6389.



C.M.&P.S.R.Y.
 BRIDGE AND BUILDING DEPARTMENT.

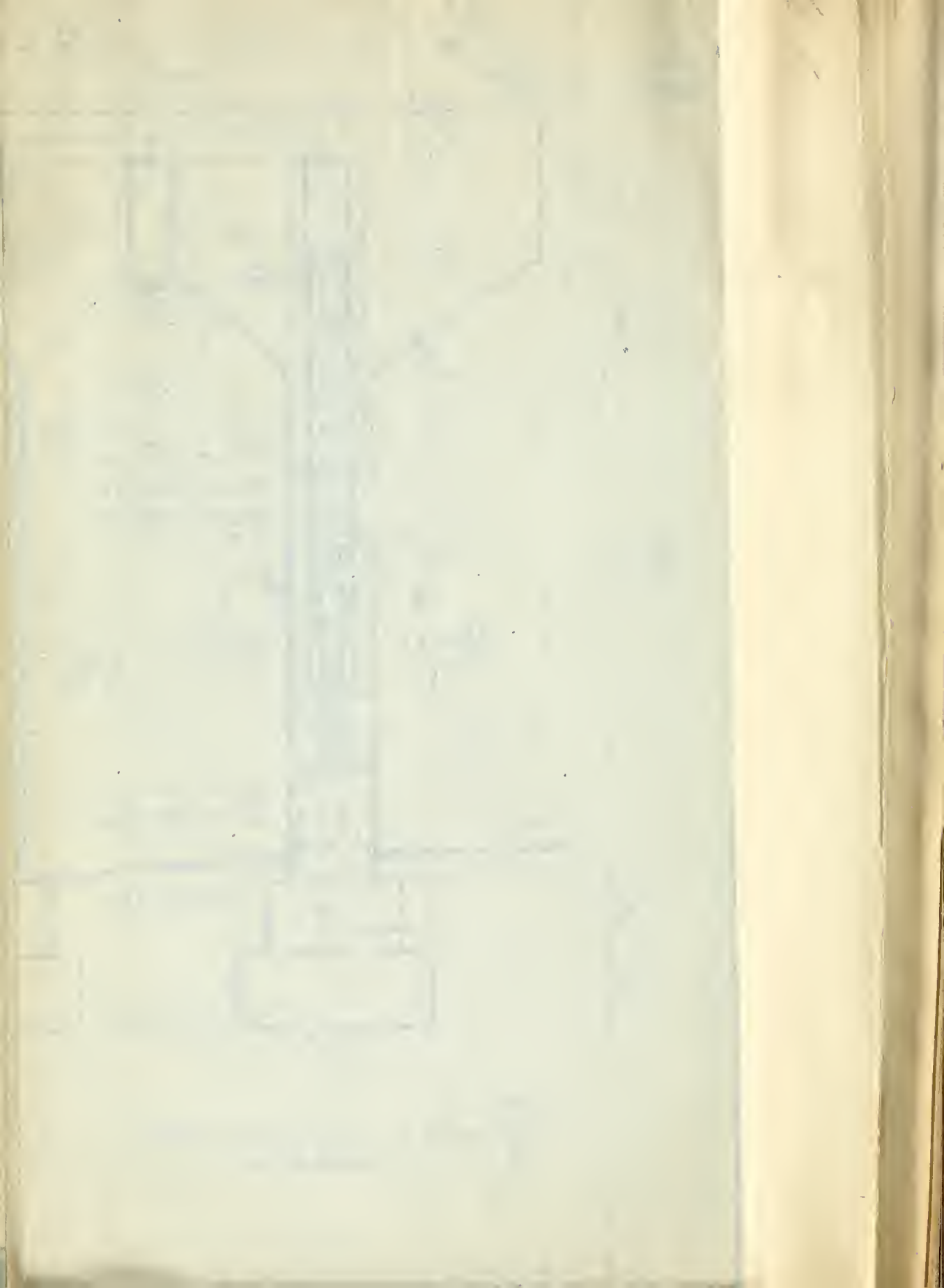
SPOKANE RIVER BRIDGE
 COEUR D'ALENE LINE — COLUMBIA DIVISION

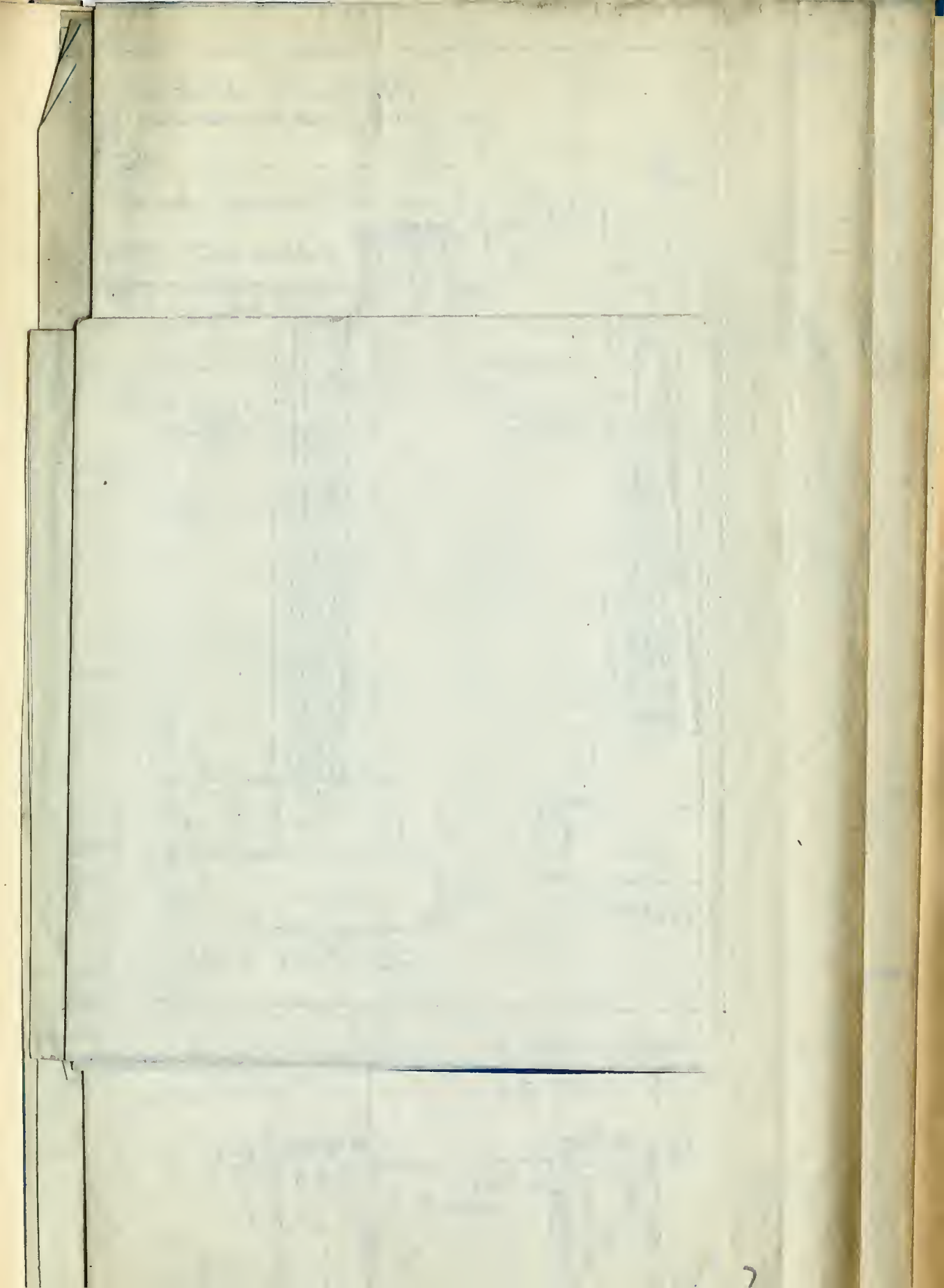
WEST ABUTMENT — PLAN & ELEVATION

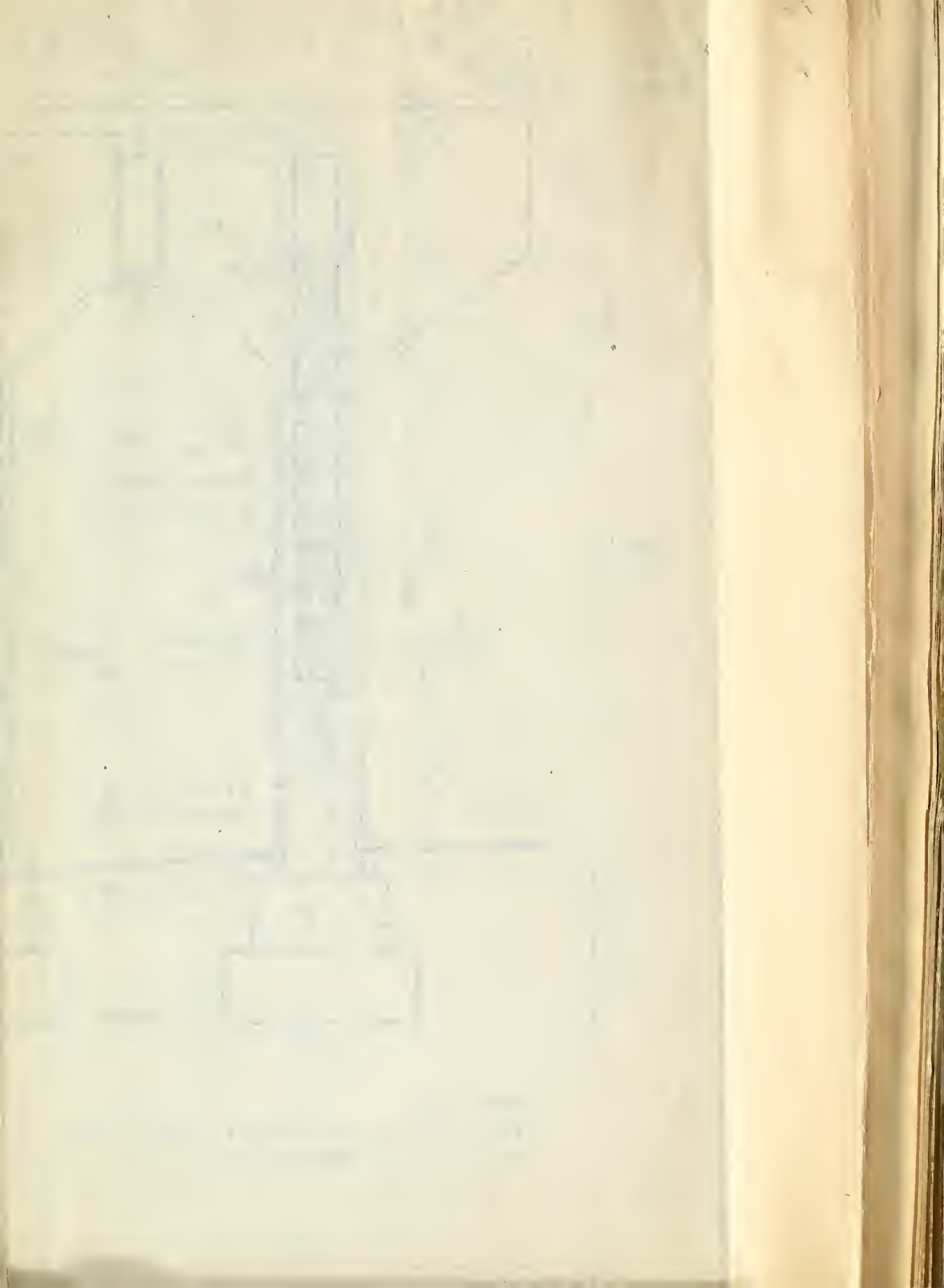
CHICAGO, AUG 27, 1910
 CORRECT

DRAWING NO. C6391
 APPROVED

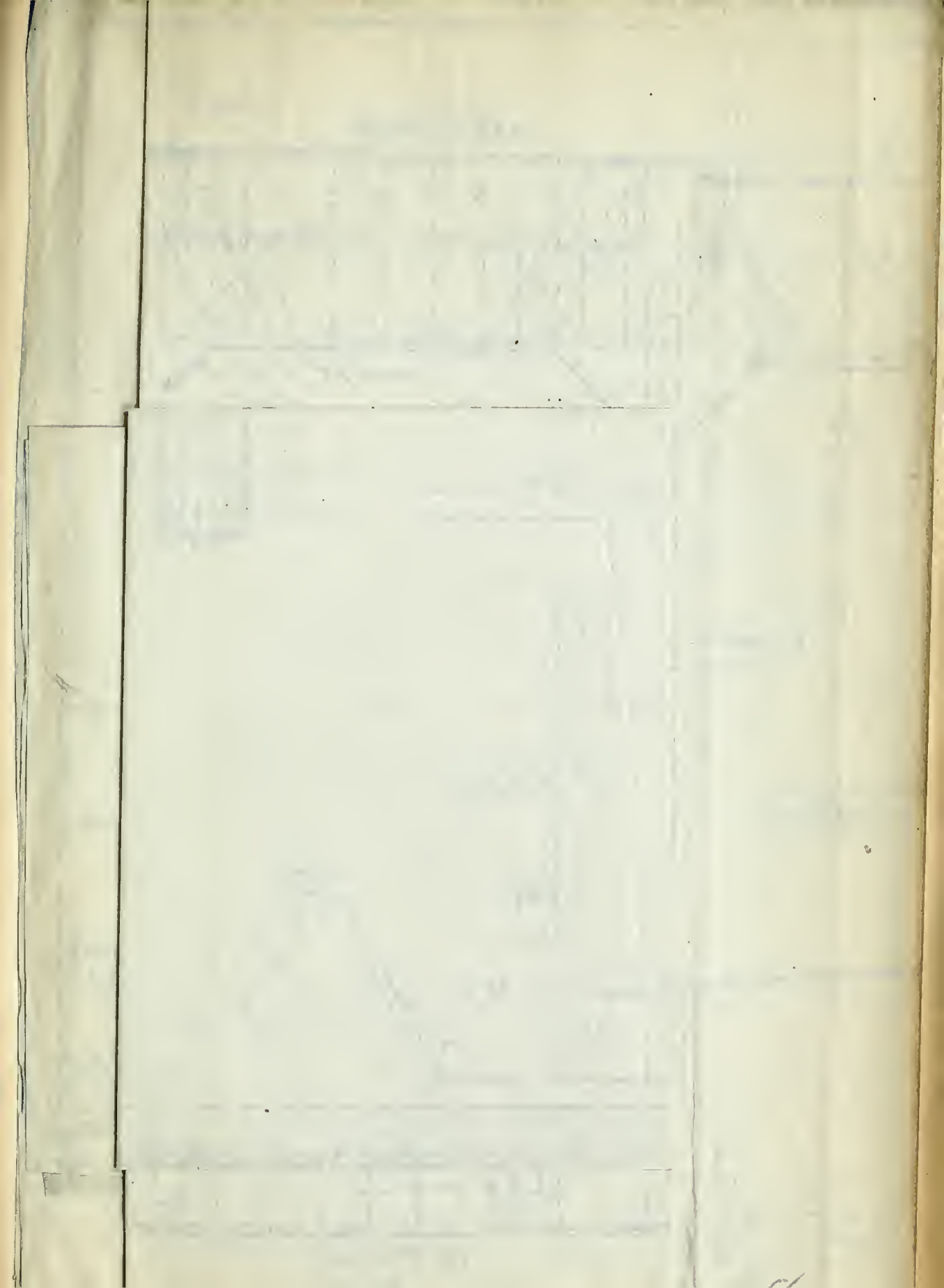
ASST. ENGR. ENGR. SUP'T. B.A.B.

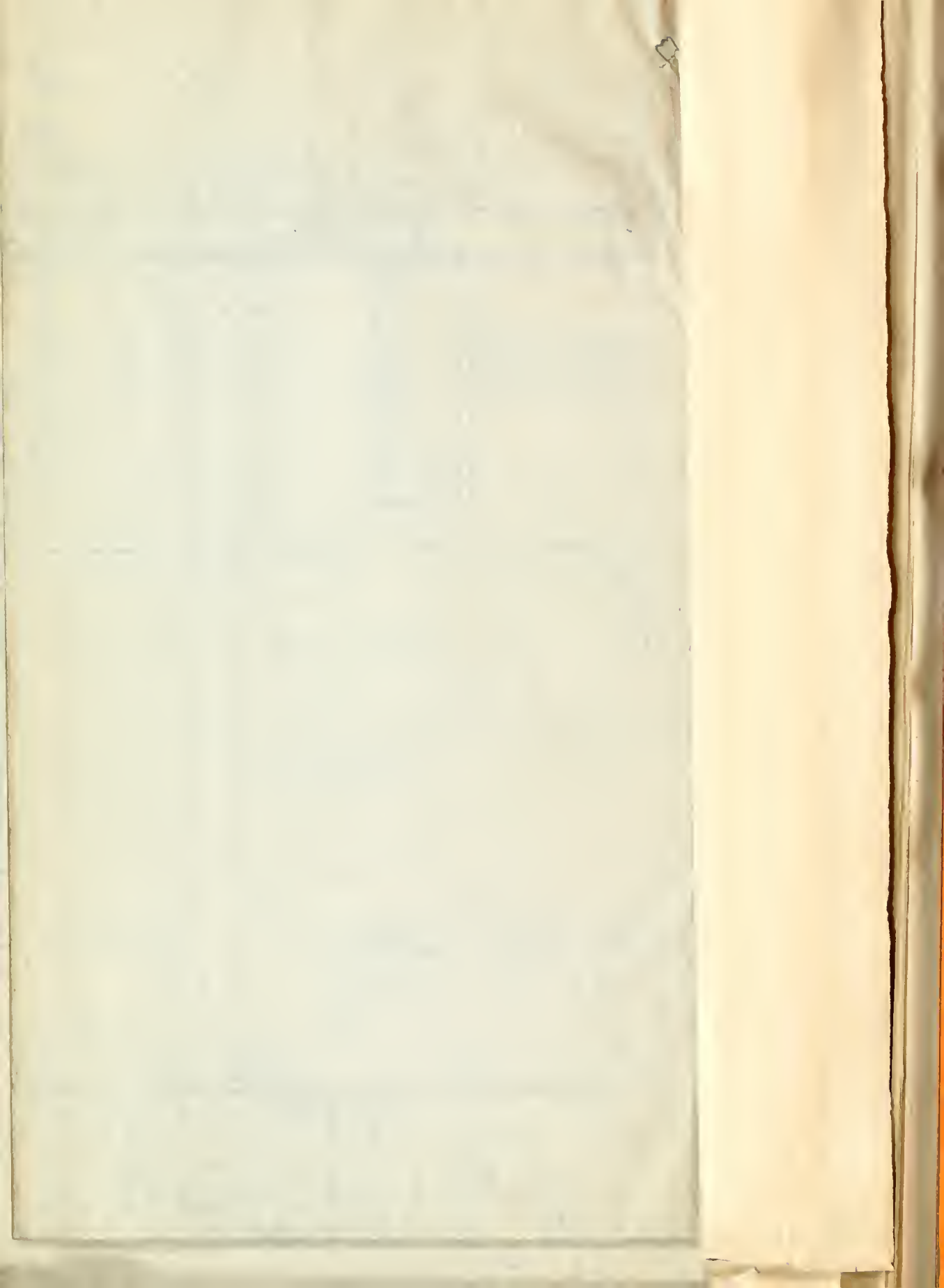


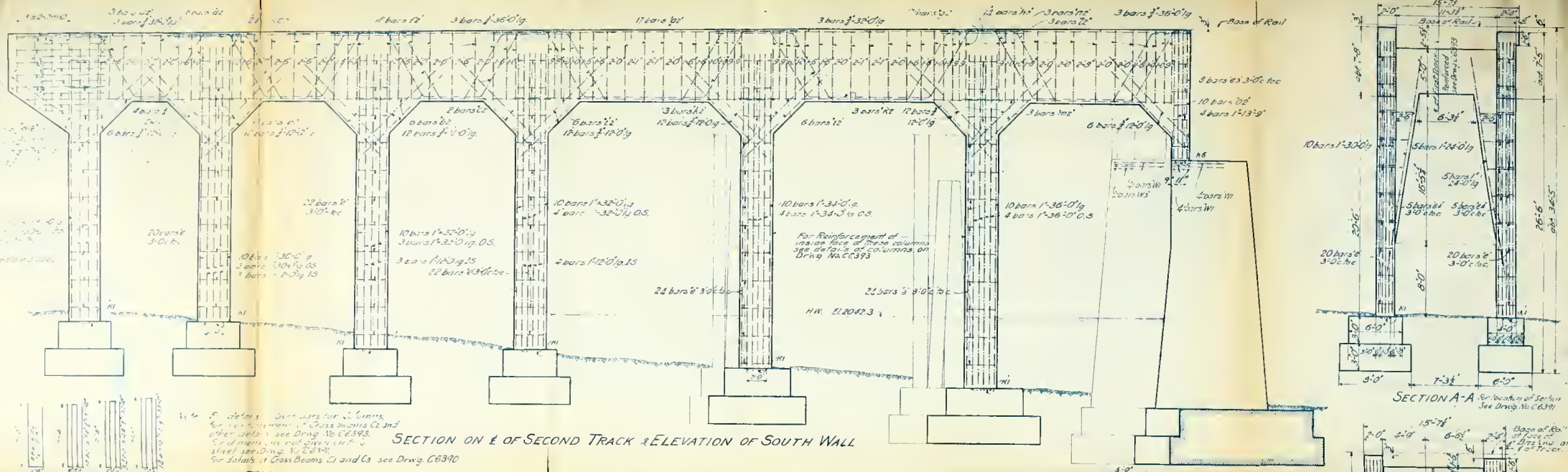






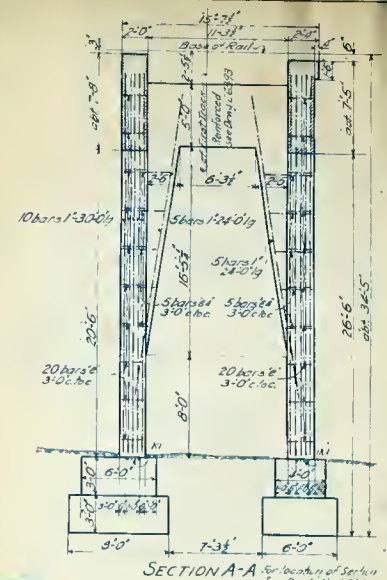




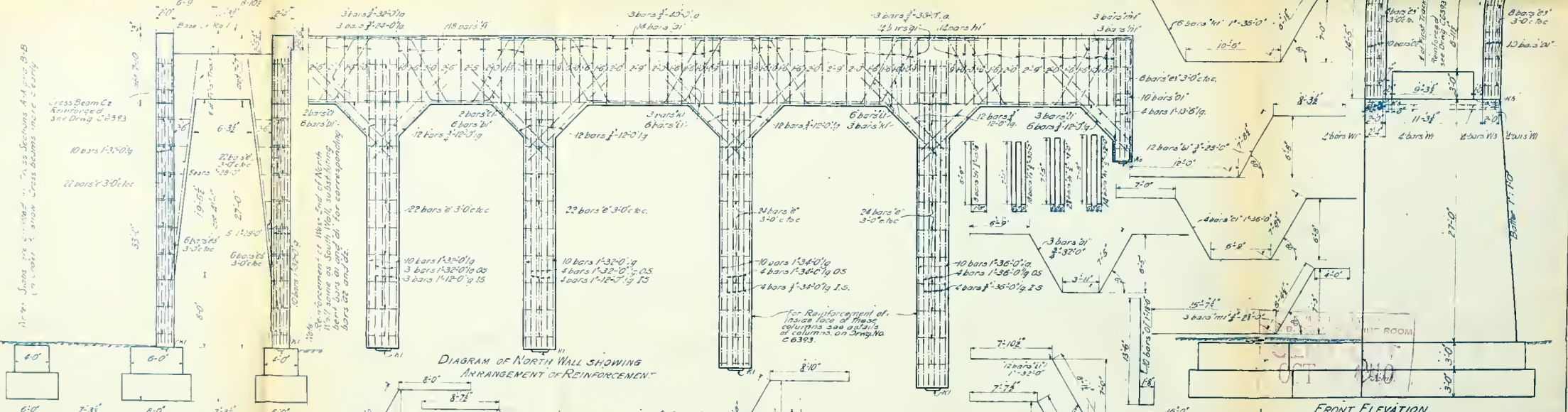


SECTION ON E OF SECOND TRACK & ELEVATION OF SOUTH WALL

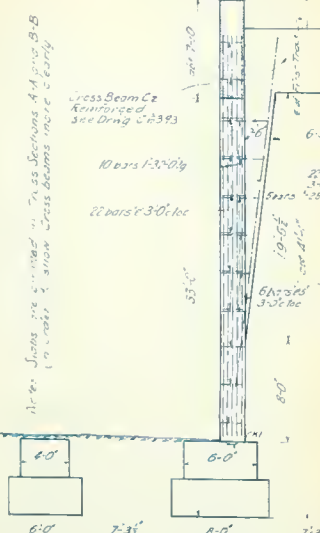
For details of columns see Drwg. No. C6390.
 For details of Cross Beams C1 and C2 see Drwg. No. C6393.
 For details of Cross Beams C3 and C4 see Drwg. No. C6394.
 For details of Cross Beams C5 and C6 see Drwg. No. C6395.
 For details of Cross Beams C7 and C8 see Drwg. No. C6396.
 For details of Cross Beams C9 and C10 see Drwg. No. C6397.
 For details of Cross Beams C11 and C12 see Drwg. No. C6398.
 For details of Cross Beams C13 and C14 see Drwg. No. C6399.
 For details of Cross Beams C15 and C16 see Drwg. No. C6400.



SECTION A-A

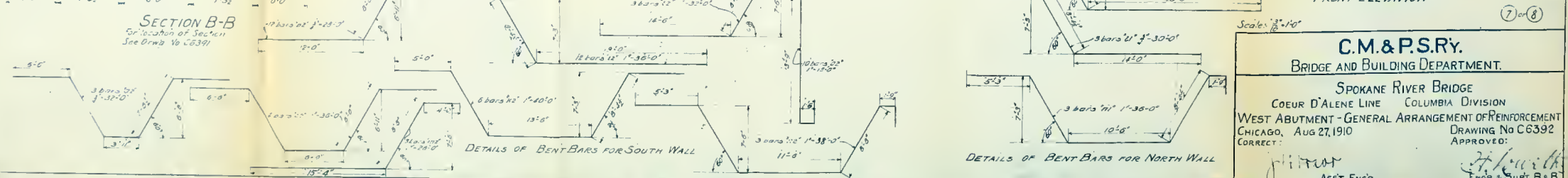


FRONT ELEVATION



SECTION B-B

DIAGRAM OF NORTH WALL SHOWING ARRANGEMENT OF REINFORCEMENT



DETAILS OF BENT-BARS FOR SOUTH WALL

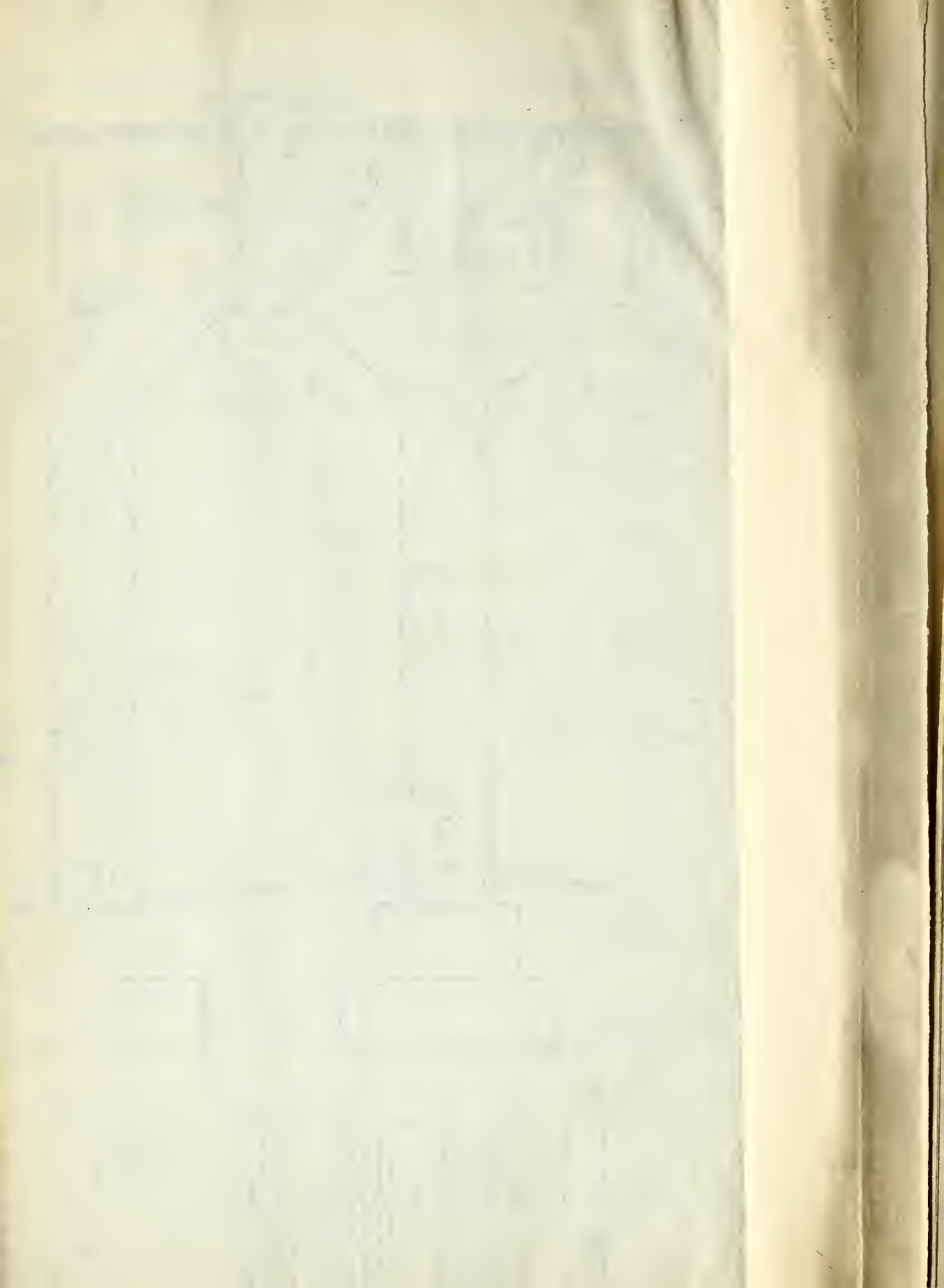
DETAILS OF BENT-BARS FOR NORTH WALL

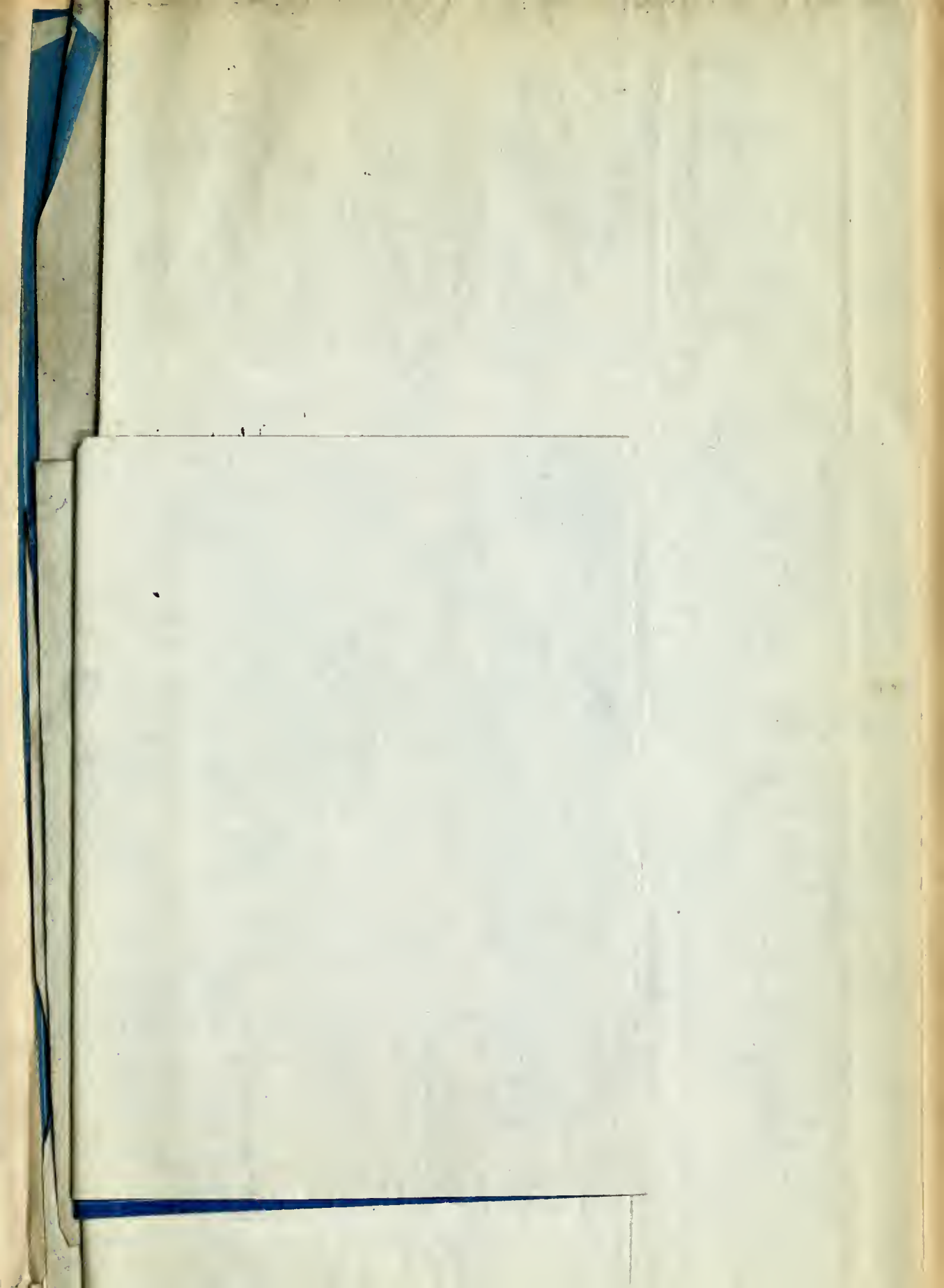
Scale: 1/4" = 1'-0"

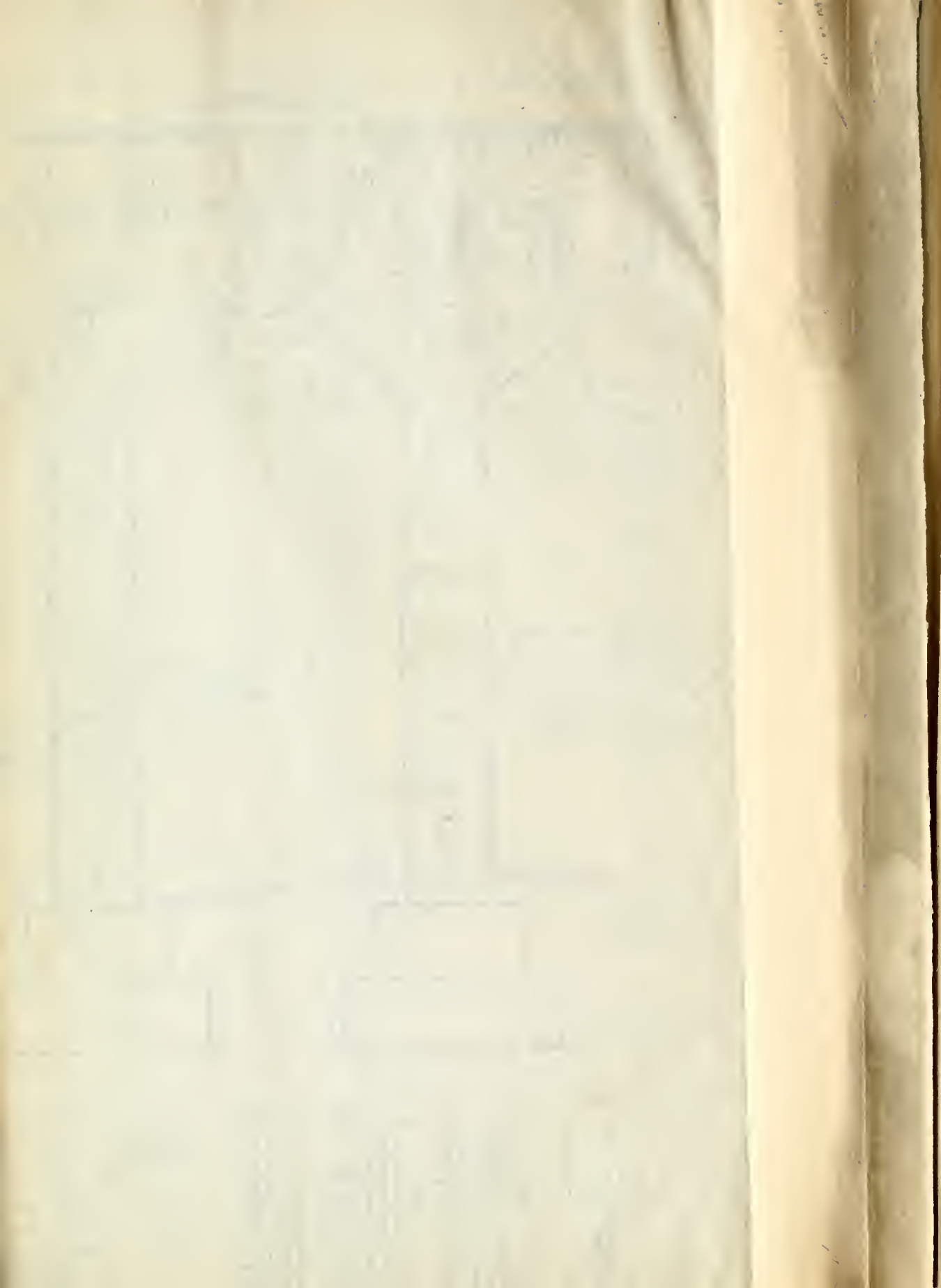
C.M. & P.S.R.Y.
 BRIDGE AND BUILDING DEPARTMENT.

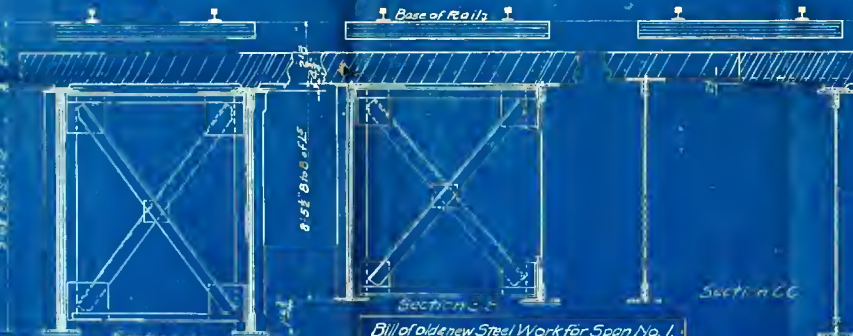
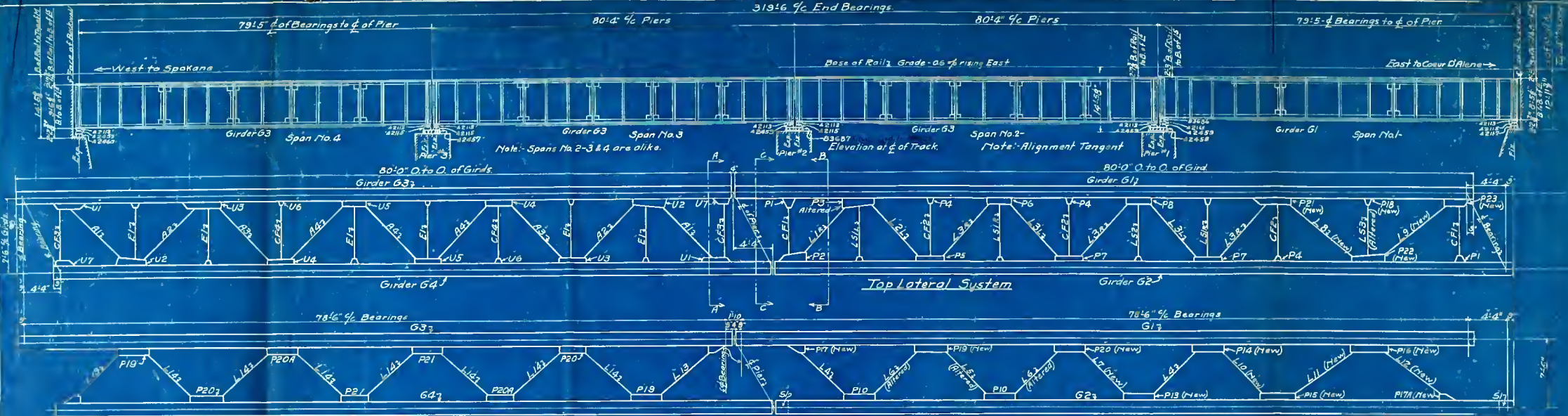
SPOKANE RIVER BRIDGE
 COEUR D'ALENE LINE COLUMBIA DIVISION
 WEST ABUTMENT - GENERAL ARRANGEMENT OF REINFORCEMENT
 CHICAGO, AUG 27, 1910
 CORRECT: APPROVED:

AWH ASST ENGR
 Eng'r & Supt. B. & B.









Bill of Castings Bolts & Sheet Lead
Furnished by Ry. Company.

No.	Description	Mark	Location	Dr. No.
16	Expansion Ends	P10	Expansion Ends	A9200
17	Fixed Ends	P11	Fixed Ends	A9200
18	Expansion Ends	P12	Expansion Ends	A9200
19	Expansion Ends	P13	Expansion Ends	A9200
20	Expansion Ends	P14	Expansion Ends	A9200
21	Expansion Ends	P15	Expansion Ends	A9200
22	Expansion Ends	P16	Expansion Ends	A9200
23	Expansion Ends	P17	Expansion Ends	A9200
24	Expansion Ends	P18	Expansion Ends	A9200
25	Expansion Ends	P19	Expansion Ends	A9200
26	Expansion Ends	P20	Expansion Ends	A9200
27	Expansion Ends	P21	Expansion Ends	A9200
28	Expansion Ends	P22	Expansion Ends	A9200
29	Expansion Ends	P23	Expansion Ends	A9200
30	Expansion Ends	P24	Expansion Ends	A9200
31	Expansion Ends	P25	Expansion Ends	A9200
32	Expansion Ends	P26	Expansion Ends	A9200
33	Expansion Ends	P27	Expansion Ends	A9200
34	Expansion Ends	P28	Expansion Ends	A9200
35	Expansion Ends	P29	Expansion Ends	A9200
36	Expansion Ends	P30	Expansion Ends	A9200
37	Expansion Ends	P31	Expansion Ends	A9200
38	Expansion Ends	P32	Expansion Ends	A9200
39	Expansion Ends	P33	Expansion Ends	A9200
40	Expansion Ends	P34	Expansion Ends	A9200
41	Expansion Ends	P35	Expansion Ends	A9200
42	Expansion Ends	P36	Expansion Ends	A9200
43	Expansion Ends	P37	Expansion Ends	A9200
44	Expansion Ends	P38	Expansion Ends	A9200
45	Expansion Ends	P39	Expansion Ends	A9200
46	Expansion Ends	P40	Expansion Ends	A9200
47	Expansion Ends	P41	Expansion Ends	A9200
48	Expansion Ends	P42	Expansion Ends	A9200
49	Expansion Ends	P43	Expansion Ends	A9200
50	Expansion Ends	P44	Expansion Ends	A9200
51	Expansion Ends	P45	Expansion Ends	A9200
52	Expansion Ends	P46	Expansion Ends	A9200
53	Expansion Ends	P47	Expansion Ends	A9200
54	Expansion Ends	P48	Expansion Ends	A9200
55	Expansion Ends	P49	Expansion Ends	A9200
56	Expansion Ends	P50	Expansion Ends	A9200
57	Expansion Ends	P51	Expansion Ends	A9200
58	Expansion Ends	P52	Expansion Ends	A9200
59	Expansion Ends	P53	Expansion Ends	A9200
60	Expansion Ends	P54	Expansion Ends	A9200
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62	Expansion Ends	P56	Expansion Ends	A9200
63	Expansion Ends	P57	Expansion Ends	A9200
64	Expansion Ends	P58	Expansion Ends	A9200
65	Expansion Ends	P59	Expansion Ends	A9200
66	Expansion Ends	P60	Expansion Ends	A9200
67	Expansion Ends	P61	Expansion Ends	A9200
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101	Expansion Ends	P95	Expansion Ends	A9200
102	Expansion Ends	P96	Expansion Ends	A9200
103	Expansion Ends	P97	Expansion Ends	A9200
104	Expansion Ends	P98	Expansion Ends	A9200
105	Expansion Ends	P99	Expansion Ends	A9200
106	Expansion Ends	P100	Expansion Ends	A9200

List of Drawings
For Spokane River Bridge.

Dr. No.	Sheet No.	Description
C6366		Details of Piers No. 1-4
C6367		Pier No. 3
C6368		Connections
C6369		Bill of Material & Marking Diagram
C6370		Details of 800 Deck Girder Span
C6371		Changes on 800 Deck Girder Span
C6372		Castings
C6373		Castings
C6374		Castings
C6375		Castings
C6376		Castings
C6377		Castings
C6378		Castings
C6379		Castings
C6380		Castings
C6381		Castings
C6382		Castings
C6383		Castings
C6384		Castings
C6385		Castings
C6386		Castings
C6387		Castings
C6388		Castings
C6389		Castings
C6390		Castings
C6391		Castings
C6392		Castings
C6393		Castings

Bill of Field Rivets for Spans No. 2-3-4
Furnished by Contractor

Read	Diam.	Grip	Length	Kind	Location	Summary of Field Rivets Req'd for Spans No. 2-3-4, + abt. 10%
42	3/8"	1 1/2"	3 1/2"	3	Top Lats. to Lats. & Girds	660
162	3/8"	2 1/2"	4"	4	Top Lats. to Girds	745
326	3/8"	1 1/2"	3 1/2"	3	Top Lats. to Girds	80
78	3/8"	1 1/2"	2 1/2"	2	Top Lats. to Lateral	30
228	3/8"	1 1/2"	2 1/2"	2	Struts to Lats. to Girds	500
6	3/8"	1 1/2"	3 1/2"	3	to Top Lats.	200
30	3/8"	2 1/2"	4"	4	Cross Frames to Top Lats. to Girds	110
36	3/8"	2 1/2"	4"	4	to Top Lats.	30
24	3/8"	2 1/2"	4"	4	Cross Frames to Top Lats. to Girds	
12	3/8"	2 1/2"	4"	4	to Top Lats.	
72	3/8"	2 1/2"	4"	4	Cross Frames to Top Lats. to Girds	
6	3/8"	2 1/2"	4"	4	to Top Lats.	
24	3/8"	2 1/2"	4"	4	Cross Frames to Top Lats. to Girds	
66	3/8"	2 1/2"	4"	4	to Top Lats.	
90	3/8"	2 1/2"	4"	4	Cross Frames to Top Lats. to Girds	
162	3/8"	2 1/2"	4"	4	to Top Lats.	
12	3/8"	2 1/2"	4"	4	Cross Frames to Top Lats. to Girds	
12	3/8"	2 1/2"	4"	4	to Top Lats.	
72	3/8"	2 1/2"	4"	4	Cross Frames to Top Lats. to Girds	
12	3/8"	2 1/2"	4"	4	to Top Lats.	
36	3/8"	2 1/2"	4"	4	Cross Frames to Top Lats. to Girds	
24	3/8"	2 1/2"	4"	4	to Top Lats.	

Bill of Steel Work for Spans No. 2-3-4
Furnished by Contractor

No.	Description	Mark	Dr. No.
G3	Girders	G3	C6377
G4	Girders	G4	C6377
G1	Girders	G1	C6376
CF9	Ed. Cross Frames	CF9	C6378
CF4	Interior	CF4	C6377
F1	Field Lateral Struts	F1	C6379
A1	Top Lateral	A1	C6379
A2	Top Lateral	A2	C6379
A3	Top Lateral	A3	C6379
A4	Top Lateral	A4	C6377
U1	Top Lateral	U1	C6379
U2	Top Lateral	U2	C6379
U3	Top Lateral	U3	C6379
U4	Top Lateral	U4	C6379
U5	Top Lateral	U5	C6379
U6	Top Lateral	U6	C6379
U7	Top Lateral	U7	C6379
U8	Top Lateral	U8	C6379
U9	Top Lateral	U9	C6379
U10	Top Lateral	U10	C6379
U11	Top Lateral	U11	C6379
U12	Top Lateral	U12	C6379
U13	Top Lateral	U13	C6379
U14	Top Lateral	U14	C6379
U15	Top Lateral	U15	C6379
U16	Top Lateral	U16	C6379
U17	Top Lateral	U17	C6379
U18	Top Lateral	U18	C6379
U19	Top Lateral	U19	C6379
U20	Top Lateral	U20	C6379
U21	Top Lateral	U21	C6379
U22	Top Lateral	U22	C6379
U23	Top Lateral	U23	C6379
U24	Top Lateral	U24	C6379
U25	Top Lateral	U25	C6379
U26	Top Lateral	U26	C6379
U27	Top Lateral	U27	C6379
U28	Top Lateral	U28	C6379
U29	Top Lateral	U29	C6379
U30	Top Lateral	U30	C6379
U31	Top Lateral	U31	C6379
U32	Top Lateral	U32	C6379
U33	Top Lateral	U33	C6379
U34	Top Lateral	U34	C6379
U35	Top Lateral	U35	C6379
U36	Top Lateral	U36	C6379
U37	Top Lateral	U37	C6379
U38	Top Lateral	U38	C6379
U39	Top Lateral	U39	C6379
U40	Top Lateral	U40	C6379
U41	Top Lateral	U41	C6379
U42	Top Lateral	U42	C6379
U43	Top Lateral	U43	C6379
U44	Top Lateral	U44	C6379
U45	Top Lateral	U45	C6379
U46	Top Lateral	U46	C6379
U47	Top Lateral	U47	C6379
U48	Top Lateral	U48	C6379
U49	Top Lateral	U49	C6379
U50	Top Lateral	U50	C6379
U51	Top Lateral	U51	C6379
U52	Top Lateral	U52	C6379
U53	Top Lateral	U53	C6379
U54	Top Lateral	U54	C6379
U55	Top Lateral	U55	C6379
U56	Top Lateral	U56	C6379
U57	Top Lateral	U57	C6379
U58	Top Lateral	U58	C6379
U59	Top Lateral	U59	C6379
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U61	Top Lateral	U61	C6379
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U63	Top Lateral	U63	C6379
U64	Top Lateral	U64	C6379
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U66	Top Lateral	U66	C6379
U67	Top Lateral	U67	C6379
U68	Top Lateral	U68	C6379
U69	Top Lateral	U69	C6379
U70	Top Lateral	U70	C6379
U71	Top Lateral	U71	C6379
U72	Top Lateral	U72	C6379
U73	Top Lateral	U73	C6379
U74	Top Lateral	U74	C6379
U75	Top Lateral	U75	C6379
U76	Top Lateral	U76	C6379
U77	Top Lateral	U77	C6379
U78	Top Lateral	U78	C6379
U79	Top Lateral	U79	C6379
U80	Top Lateral	U80	C6379
U81	Top Lateral	U81	C6379
U82	Top Lateral	U82	C6379
U83	Top Lateral	U83	C6379
U84	Top Lateral	U84	C6379
U85	Top Lateral	U85	C6379
U86	Top Lateral	U86	C6379
U87	Top Lateral	U87	C6379
U88	Top Lateral	U88	C6379
U89	Top Lateral	U89	C6379
U90	Top Lateral	U90	C6379
U91	Top Lateral	U91	C6379
U92	Top Lateral	U92	C6379
U93	Top Lateral	U93	C6379
U94	Top Lateral	U94	C6379
U95	Top Lateral	U95	C6379
U96	Top Lateral	U96	C6379
U97	Top Lateral	U97	C6379
U98	Top Lateral	U98	C6379



